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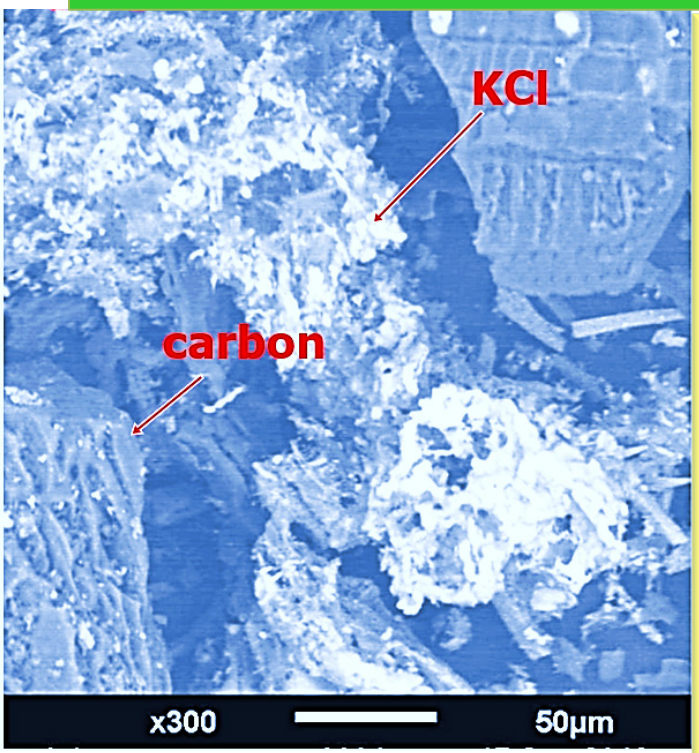

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Cover Photo is from published article ITJEMAST V5(2) of Nirwan Syarif and Marini Cinthya Pardede (2014) "Hydrothermal Assisted Microwave Pyrolysis of Water Hyacinth for Electrochemical Capacitors Electrodes." Photo shows Micrographic image 300 times magnification of water hyacinth carbon.

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An After-Stay Satisfaction Survey of Residents Living in Prefabricated Concrete Structures in Thailand

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ABSTRACT

We have conducted an after-stay satisfaction survey of residents living in prefab concrete buildings. Many modern fast constructions make use of prefab parts, but no research on living satisfaction has been made. Multiple criteria questionnaire survey has been conducted to find out satisfaction on comfortable lives. Nine criteria have been surveyed: moisture protection, noise prevention, safety of structures, thermal prevention, air flow, external appearance, interior, facility, and overall satisfaction. Comparisons from the survey results in term of five-level Likert scale satisfaction are drawn from prefab-made dormitories, detached houses, and townhouses. The surveyed results are somewhat identical, but noise problems are the most concerns for people living in dormitories. For prefab-made detached houses and townhouses, problems in renovation and augmentation are highly alike in terms of difficulties and complexities, compared to non-prefab-made houses.

1. Introduction

In Thailand, prefabricated concrete parts have been even more widely used in various types of constructions as it provides quick construction process with factory quality control.

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However, dwellers have never been asked if living in prefab structures provides satisfaction in terms of comfortable living and safety concerns. Therefore, our aim is to find out such satisfaction. Three residential types are studied including dormitories, detached houses, and townhouses (terraced houses). Questionnaires have been responded by 240 dwellers from Pathumtani and Chonburi provinces, Thailand. The survey data of each criterion is averaged to find the mean.

2. Literature Review

Auditing construction process through the use of total quality management has been suggested in order to meet customer satisfaction while maintain profitability (Hellard, 1993). Construction management and real estate sectors have faced a changing world with more specific demands and higher competitions (Kärnä, 2009). Prefabricated buildings use quality control components transported from factory to be assembled at the building site. This reduces some of the construction processing problems but greatly succinct construction time. Cost is always a concern with construction. The main prefab advantages are less time and waste, thus have cheaper cost (Diamond, 2010). Factors of Japanese prefab housing were studied after improving industrialized housing quality studied by Noguchi (2003). Great customer satisfaction makes widespread great reputation, thus more prefab houses are built especially more expensive high-quality homes.

In Malaysia, Mohammad (2009) studied the relationship between quality and satisfaction of house owners with construction systems and collected data by using sets of questionnaires. The SPSS software has been used to analyze the surveyed data. The study showed that house owners were highly satisfied with their houses and there was no significant relationship between quality and house owners' satisfaction except for the mechanical and electrical aspects of prefab and traditional construction systems.

In Florida, house design, house quality and service have been studied to empirically examine home builders' performance as measured by the degree of home buyers' satisfaction (Torbica and Stroh, 2001). In Finland, Kärnä (2009) studied customer satisfaction in construction and the factors affecting it and discuss utilizing and measuring the customer data in the multi-dimensional business environment of construction.

3. Methodology

3.1.1 Customer Satisfaction

Customer satisfaction is a term used to indicate how products and services meet or exceed customer expectation or specified satisfaction goals. This work uses questionnaire as a tool to survey individual households regarding their satisfactions of the building they are living in.

3.2 Questionnaire Survey

A questionnaire consists of a series of questions (open-ends or closed-ended questions). Total nine criteria are asked, including moisture protection, noise prevention, safety of structure, airflow, thermal prevention, external appearance, interior, facilities, and overall satisfaction. Each criterion, there are five satisfaction levels to be answered. A privacy statement is noted that the identity of interviewers is not collected. The pilot test questionnaire is conducted for ten respondents to obtain feedbacks for improvements. After the pilot test, the questionnaires are revised such that each question can be more clearly understood. The satisfactions are derived from the five Likert scale questionnaire with

1: No satisfaction,
2: Fair satisfaction,
3: Satisfaction,
4: Good Satisfaction, and
5: High Satisfaction.

In this study, total 240 respondents are randomly selected from three habitat types, dormitories, detached houses, and townhouses. A wide range of respondents is from different age groups of males and females.

4. Study Result and Discussion

Respondents classified by Gender, Ages, and Habitats are illustrated in Table 1. Most of the respondents are 20-40 age groups. Townhouse respondents are about half of the respondents from detached house and dormitory.

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Table 1: Three-way cross tabulation: Respondents classified by Gender, Ages, and Habitats

Habitats		Ages				Total
		<=20	21-40	41-60	>60	
Townhouse	male	0	12	6	0	18
	female	1	18	5	1	25
	Total(percent)	1(2.32%)	30(%69.76)	11(25.58%)	1(2.32%)	43(100%)
Detached house	male	13	14	15	5	47
	female	14	23	12	8	57
	Total(percent)	27(25.96%)	37(35.57%)	27(25.96%)	13(12.5%)	104(100%)
Dormitory	male	18	25	1		44
	female	24	25	0		49
	Total(percent)	42(45.16%)	50(53.76%)	1(1.07%)	0(0%)	93(100%)
Grand Total(percent)		70(29.17%)	117(48.75%)	39(16.25%)	14(5.83%)	240(100%)

Table 2: Frequencies of population classified by satisfaction criteria

Criteria		Frequencies					Mean	Standard Error of Mean
		Satisfaction level						
		1	2	3	4	5		
Moisture protection	n	8	30	69	103	30	3.49	0.063
	percentage	3.3%	12.5%	28.8%	42.9%	12.5%		
Noise prevention	n	28	44	64	75	29	3.14	0.077
	percentage	11.7%	18.3%	26.7%	31.3%	12.1%		
Safety of structure	n	26	33	69	73	39	3.28	0.078
	percentage	10.8%	13.8%	28.8%	30.4%	16.3%		
Airflow	n	10	51	116	54	9	3	0.056
	percentage	4.2%	21.3%	48.3%	22.5%	3.8%		
Thermal prevention	n	6	35	122	66	11	3.17	0.053
	percentage	2.5%	14.6%	50.8%	27.5%	4.6%		
External appearance	n	3	10	74	110	43	3.75	0.054
	percentage	1.3%	4.2%	30.8%	45.8%	17.9%		
Interior	n	0	19	81	107	33	3.64	0.053
	percentage	0.0%	7.9	33.8%	44.6%	13.8%		
Facilities	n	0	19	101	82	38	3.58	0.055
	percentage	0.0%	7.9	42.1%	34.2%	15.8%		
Overall	n	0	23	95	92	30	3.54	0.054
	percentage	0.0%	9.6	39.6%	38.3%	12.5%		
Total							3.40	0.060

Table 2 shows the percentage on each satisfaction level for all criteria. Most residential satisfactions are level 3 and 4 for every criterion. Moisture protection, safety of structure, external appearance and interior, and noise protection criteria yield good satisfactions (level 4). Airflow, thermal prevention, facilities and overall satisfaction give medium satisfactions (level 3). Obviously, interior, facilities and overall criteria show no satisfaction (level 1). Means of all criteria are in ranges of 3 to 4 out of 5. Figure 1, the satisfaction mean is classified by male and female, in percentages. Both male and female, the mean results for facilities, external appearance and interior criteria show good satisfaction (level 4). The survey yield medium satisfaction (level 3) for airflow, thermal prevention, moisture protection, noise protection, safety of structure, and overall satisfaction.

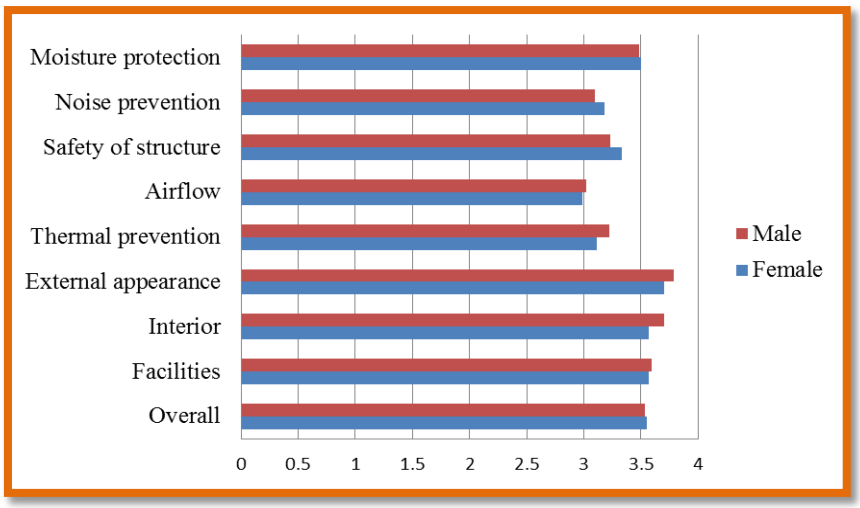

Figure 1: Averaged satisfaction bar chart classified by gender.

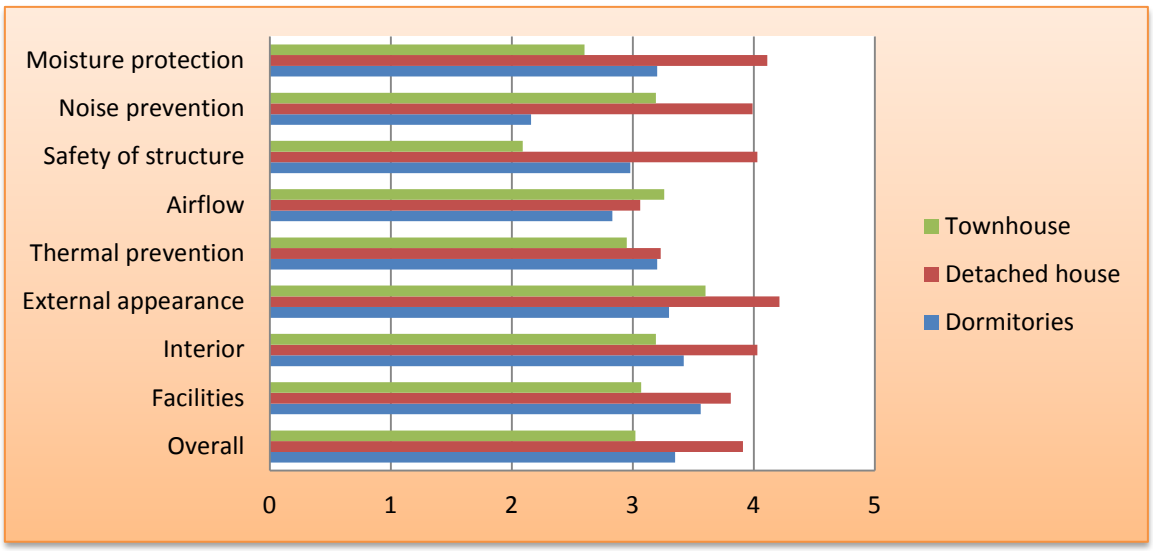

Figure 2: Averaged satisfaction bar chart, classified by habitats.

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Figure 2 the satisfaction mean is classified by townhouse, detached house and dormitory, in percentages. For townhouse, mean of safety of structure criteria gives a fair satisfaction (level 2). External appearance criteria yield good satisfaction (level 4). For the rest the highest percentages are medium satisfactions. For detached houses, most satisfaction criteria yield good satisfaction except that airflow and thermal prevention yield medium satisfaction. For dormitory, mean of noise prevention criteria yield fair satisfaction (level 2). Facilities criteria give good satisfaction (levels 4). For the rest of the satisfaction criteria are medium satisfaction (level 3).

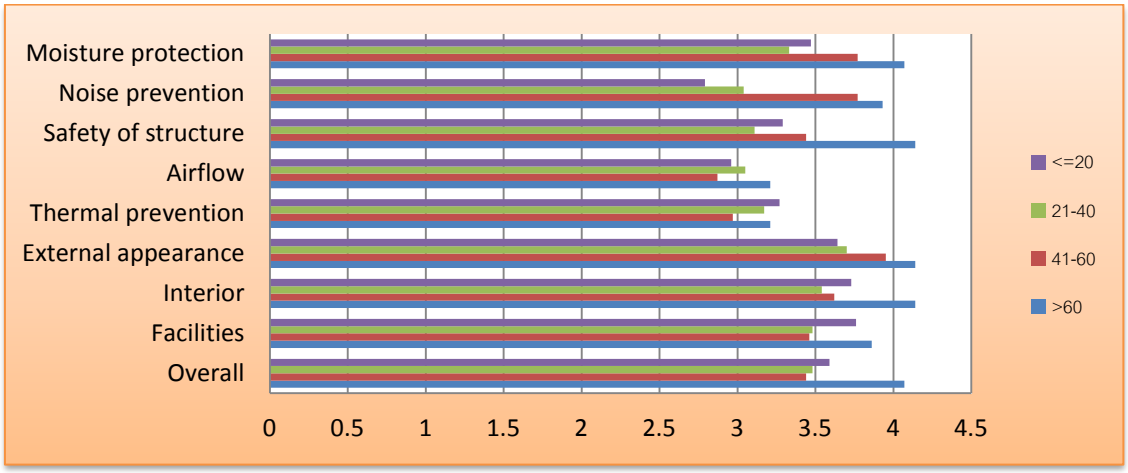

Figure 3: Averaged satisfaction bar chart, classified by age groups.

Satisfaction means are classified by age as showed in Figure 5.3. For age group <=20, moisture protection, noise prevention, safety of structure, airflow, and thermal prevention criteria yield medium satisfaction (level 3). For 21-40 age groups, both external appearance and interior criteria show good satisfaction (level 4) followed by 41-60 age groups, moisture protection, noise prevention, external appearance, and interior criteria give good satisfaction (level 4). Finally >60, airflow and thermal prevention give medium satisfaction (level 3).

5. Result Summary

The total population of the sample is 240 persons, being male 109 (45.4%) and female 131 (54.58%). Satisfactions of respondents are classified by gender, habitat, and age groups. From the analysis of all questionnaire questions with five satisfactory levels, overall mean is 3.40 with standard mean error 0.06. For consideration regarding habitat types, means of

townhouse, detached house, and dormitory satisfaction are 3.00, 3.82, and 3.11, respectively. Means of townhouse and dormitory are lower than detached house due to low means of safety of structure, moisture protection, and noise prevention criteria. For consideration regarding range of age, satisfactions for noise prevention and airflow criteria are low for ≤20 and 21-40 age groups, and for airflow and thermal prevention are low for 41-60 and >60 age groups.

6. Conclusion

This work studies about after-stay satisfaction survey of people inhabiting in three types of prefab concrete buildings: townhouse, detached house, and dormitory. A questionnaire survey has been focused to find out satisfaction on comfortable lives. We have total 240 respondents. Nine criteria have been surveyed: moisture protection, noise prevention, safety of structures, thermal prevention, air flow, external appearance, interior, facility, and overall satisfaction. The surveyed results are somewhat identical, but noise problems are the most concerns for people living in dormitories. We also found that, for prefab-made detached houses and townhouses, problems in renovation and augmentation are highly alike in terms of difficulties and complexities, compared to non-prefab-made houses. Results will be statistically analyzed and presented in the next work.

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Hydrothermal Assisted Microwave Pyrolysis of Water Hyacinth for Electrochemical Capacitors Electrodes

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ABSTRACT

We develop 'green' approach to prepare conductive carbon material from water hyacinth (*Eichhornia crassipes*) powder for use in electrochemical capacitor device. The features on morphology, crystallography and surface functionality were analyzed based on SEM, XRD and FTIR instrumentation, respectively. The electrical conductivities were measured using four-point probe. Electrochemical properties were studied using cyclic voltammetry. SEM analyses indicated the existence of nanoparticles in the carbon samples. XRD analysis showed that carbon sample had sharp peaks indicating crystallite carbon and sylvite. FTIR analysis showed that the carbon have common surface functionalities which also can be found in other conductive carbon samples. The electrical conductivities test showed that the carbon had 0.001–1.5 S cm^{-1} of conductivity. The shape of the cyclic voltammograms were typical for carbon electrode that use in electrochemical capacitor

1. Introduction

Water hyacinth (WH) of the title as the most obnoxious aquatic plants in the world. It can be easily grown in various water sources, and becomes the issue for most of countries. It is estimated that the population in one acre area containing 2 million individuals with a total weight of 500 tonnes. With such rapid growth, WH become more worst as for urban

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communities, because it is main factor on silting of rivers, breeding places of mosquitoes and snakes, and give the slum impression to the region.

There are many ways to overcome its growth problems, one of them is by using re-use approaching, i.e. by way of the process into a product that has economic value. It contains organic fiber that physically can be processed into raw material of fertilizers manufacture (Patil *et al.* 2012), fibre board (Markland 2003), and carbon absorbent (Somboon *et al.* 2012). The composition of WH plant consist of 3.50% lignin, 48.70%, hemicellulose, 18.20% cellulose and 13.30% crude protein (Magdum *et al.* 2012). Considering that organic matter content is quite large, therefore the WH has potential to be developed as carbon electrode material in electrochemical devices.

In this work, water hyacinth (*Eichhornia crassipes*) was used to prepare carbons using hydrothermal assisted microwave pyrolysis technique. The method was chosen based on the ability to transform cellulosic materials into conductive carbons without much change in pores structures. High electrical conductivity and pores volume are basic requirement for the best electrochemical performance of carbon electrodes.

The electrode was applied as working electrode in the three electrodes system using base, acid and salt aqueous medium. The materials were characterized in terms of crystallographic, surface chemistry and electrical conductivity. Carbon electrode would be applied in energy storage or conversion devices, such as, electrochemical capacitor (supercapacitor), fuel cell and battery.

2. Materials and Methods

WH powder was used as raw material to prepare carbon. The powder was rinsed in tap water and dried in the sun light after 24 hours. As much as 40 g dry WH powder, 20mL demin water and 200 mg catalyst KOH put into 250 mL hydrothermal reactor. The reactor was heated in electrical oven at 180 ˚C for 16 hour for generated 30 bar hydrothermic pressure inside reactor chamber. The process obtained brownish black constituent that called torrefaction material. The material was transferred from the hydrothermal reactor to microwave furnace and pyrolyzed in domestic microwave oven at 1000 watts full power for 25 minutes. In this condition, the temperature inside furnace can reached 800 ˚C. Carbon was

tapped from the furnace after being cold in room temperature.

The EC electrodes were fabricated by mixing the WH carbon powder and graphite (50:50) bind together with 10% w/w of bronze filled epoxy resin (Dexton, USA). Circular electrodes were obtained from 0.5 g of mixture paste in a 10 mm diameter mold, and pressed under 3 tons load and were heated on a hot plate at 50°C for an hour.

SEM micrographs were obtained on JEOL JED-2300. X-ray difraction (XRD) patterns of the carbons were obtained on a Shimadzu X-ray difractometer XRD 7000 operating at 40 kV and 30 mA, using Cu-K_α radiation. FTIR spectra were obtained on Shimadzu IR Prestige 21. The pore structures were determined using mathematical model derived from iodine number and methylene blue number suggested by Nunes (2011). The electrical conductivities were measured using four point probe. Electrochemical properties were studied using cyclic voltammetry (CV). Electrochemical test for the electrodes were conducted in potentiostat (Cheapstat, University of California Santa Barbara, CA, USA) in aqueous electrolytes, i.e. H_2SO_4, KOH, $NaHCO_3$ and $K_2C_2O_4$. The potentiostat is capable for doing three electrodes configuration CV measurement with Ag/AgCl electrode as reference electrode and platinum rod as the counter electrode (Rowe *et al.* 2011).

3. Results and Discussion

Hydrothermal assisted microwave pyrolysis of water hyacinth produced high crystallite material containing graphitic carbon (47%) and KCl (20%) as revealed by the EDX measurement (Figure 1 C). Figure 1 A-B show micrographic images from carbon with 300, and 2000 times magnification. It is clearly visible that the carbon consists two distinguish features, i.e. waffle structures with a lot of cavities or pores and shining bead chain. The structures with cavity are well known as carbon with pores and the bead chain are KCl (sylvite). The carbon pores have diameters in the range of 10-50 nm. KCl crystal built some clusters (particles) as shown in Figure 1B. The size of the KCl particles were vary in the range of 10-17 nm.

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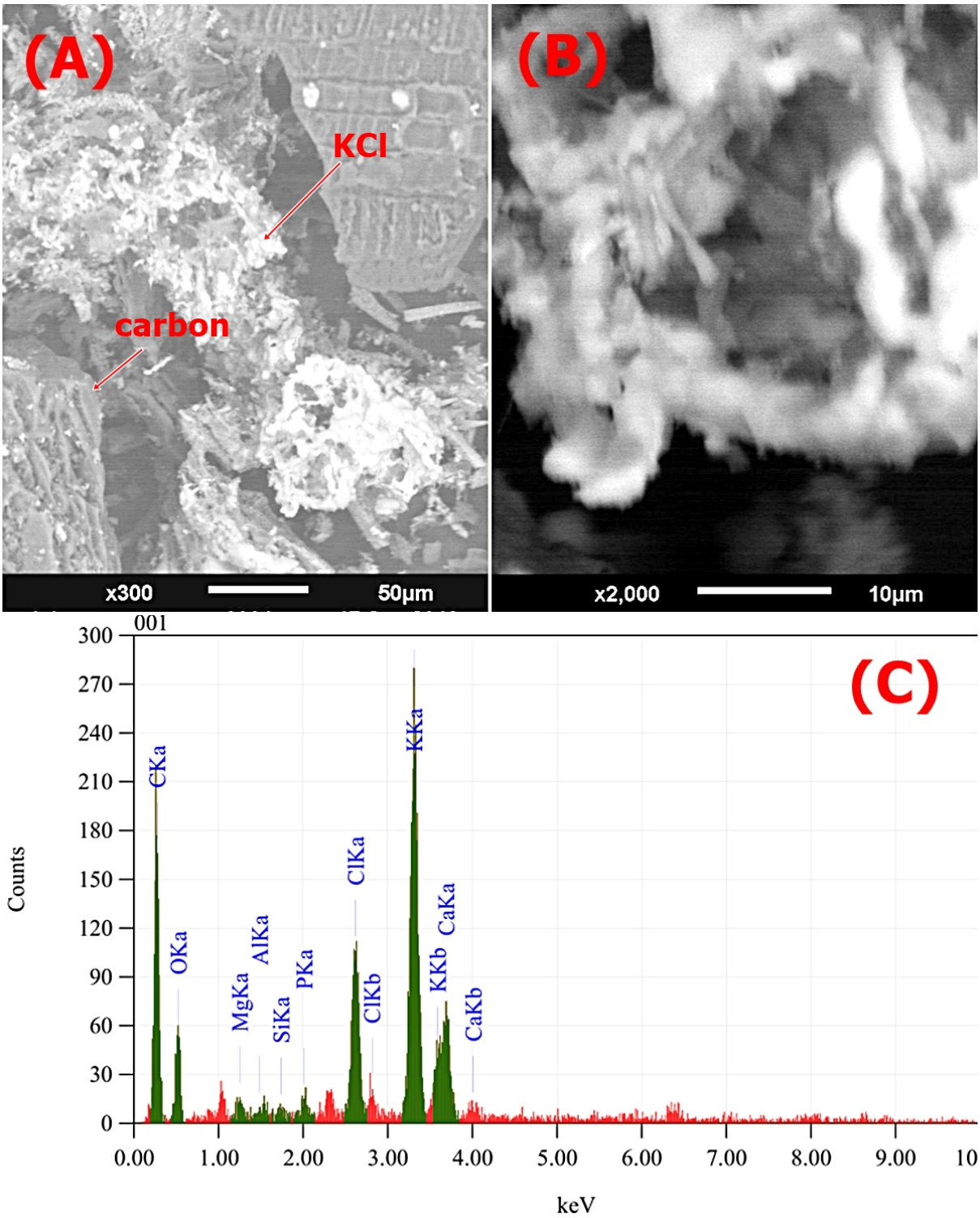

Figure 1: Micrographic image (A) 500 times (B) 20,000 times magnification and (C) EDX analysis of water hyacinth carbon

XRD difractogram (Figure 2) confirm that the material contained relatively large crystallite of KCl and turbostratic feature of carbon, i.e. mixing of amorphous and graphitic carbon or 2D carbon crystal. Figure 2 also reveals the excitation of other crystallite, that

match XRD pattern for KCl (sylvite) crystal. The crystal would become more attractive because present as larger crystallite detect as sharp peaks both 29˚ and 42˚.

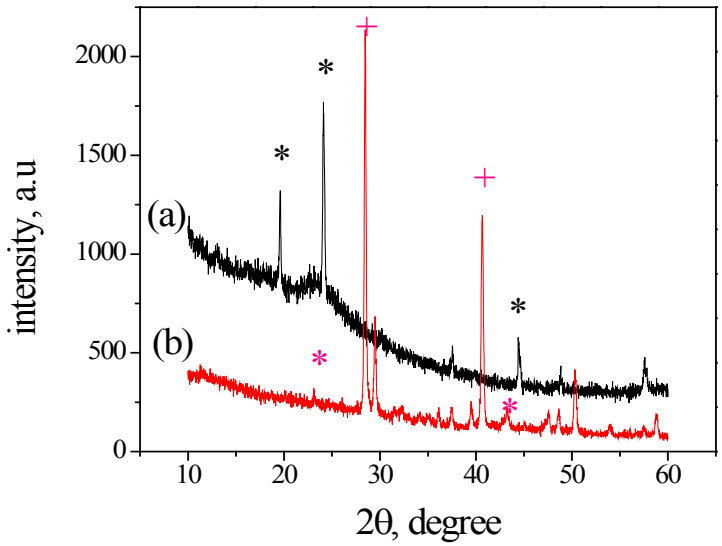

Figure 2: XRD spectrogram of (a) commercial activated carbon (Ciba) was added for clarify reading and (b) WH carbon,
(* = Carbon, ICDD no. 41-1487; + = KCl (Sylvite), ICDD no. 64-0312; others would be considerable as SiO_2, Al_2O_3, and CaO especially for WH carbon)

Other oxides might be co-exist in the carbon matrices, such as SiO_2, Al_2O_3 dan CaO because they inherently are important components or factors in plant histology. The XRD patterns of the carbon (Figure 2) show intense peaks at 2θ = 24° and 44° which respectively correspond to the [011] and [002] difractions of the graphitic framework confirm that the carbon materials have amount of graphitic carbon.

In 800 ˚C of temperature, the conductivity of the carbon started to be formed along with termination of the acid functional groups from the surface of the carbon. The decomposition of the functional groups produced H_2O and CO_2. In other words, carbon lost its functional group together with the increasing temperature followed by the reform of its hexagonal structures. It would be different after carbon was cooled. The hexagonal structure of the carbon would re-obtained with volatile molecule and reformed the functional groups of the carbon and thus the carbon increasing the resistivity as the functional groups formed on the carbon surface is quite excessive. It is clearly shown in Figure 3 that the carbon spectra has double small peaks in around 2300 – 2400 cm^{-1} which is the sum of some double bond stretching vibration of C=N, C=O and N=O. Single bond vibration band of C and O appears

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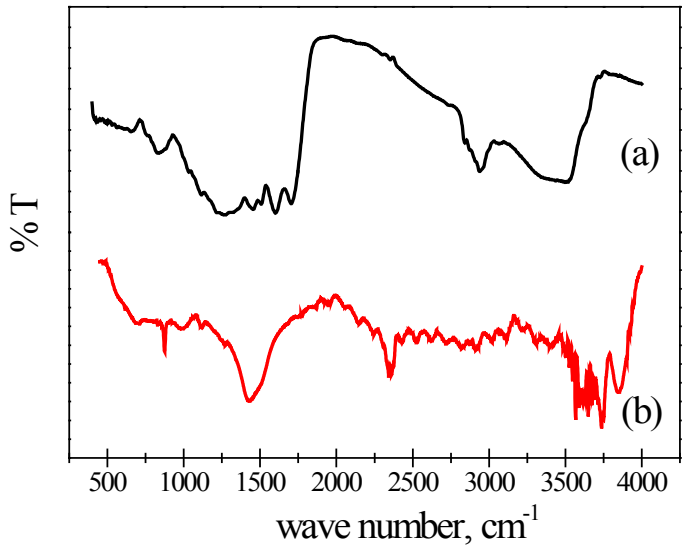

Figure 3: FTIR spectra of (a) commercial activated carbon (Ciba) was added for clarify reading and (b) WH carbon.

in 1400 cm^{-1} as broad peak. The height of the peaks indicated the presence of bending vibrations for same bonding configurations, such as C-O-C, C-O-O, and C-C-O (Matson *et al.* 1970). Spectrogram shows functional groups related to vibration presence of free O-H in 3800 – 4000 cm^{-1}.

The change in crystallography and surface functional groups will affect the electrical resistivity of carbon. Electrical resistivity is proportional to the magnitude of electrical conductivity (Mochidzuki *et al.* 2003). Therefore, conductivity can be explained by the results of resistivity measurement. Electrical conductivity values of carbon are influenced by the presence of sp^2 carbon in the activated carbon. The conductivity were measured between 0.001 – 1.500 S cm^{-1}.

Non-faradaic process in carbon electrode was detected in voltammogram with slope features indicating resistance of electrolyte solution that causes a voltage drop (Myland *et al.* 2002). The specific capacitance of carbon electrodes were calculated by using mathematical formula (equation [1]) and the integration of voltammogram curve $\left(\int IdV\right)$ were measured by using mathematical software (Kuo et al. 2007). Where ΔQ is the total amount of the charge accumulated over a potential window, ΔV, w is the mass of the electrode active material, I is the current, and s is the potential scan rate.

$$C_{avg} = \frac{\Delta Q}{(w \times \Delta V)} = \frac{\left(\int IdV\right)}{(s \times \Delta V \times w)} \quad (1)$$

The area in voltammogram curves for water hyacinth carbon electrode become wider as the increasing of scan rate and reach the maximum value of 0.26 Fg^{-1} in 2 mV/s (Figure 4). Specific capacitances were calculated and derived from acid (H_2SO_4), base (KOH) and salt electrolyte ($K_2C_2O_4$) were 0.0218, 1.4920 and 0.0168 Fg^{-1}, respectively (Figure 5). The surface area of WH carbon has 300 – 850 cm^2g^{-1} which dominated by micropores (60 – 80%) considerably support improving performance of the electrode. Effect of KCl (sylvite) crystal in carbon matrices should take into account because XRD difractogram suggested that the crystal is quite large. It is well known that KCl is generally used as the electrolyte. Therefore, it is make sense that KCl provides synergistic effect on the electrosorption process.

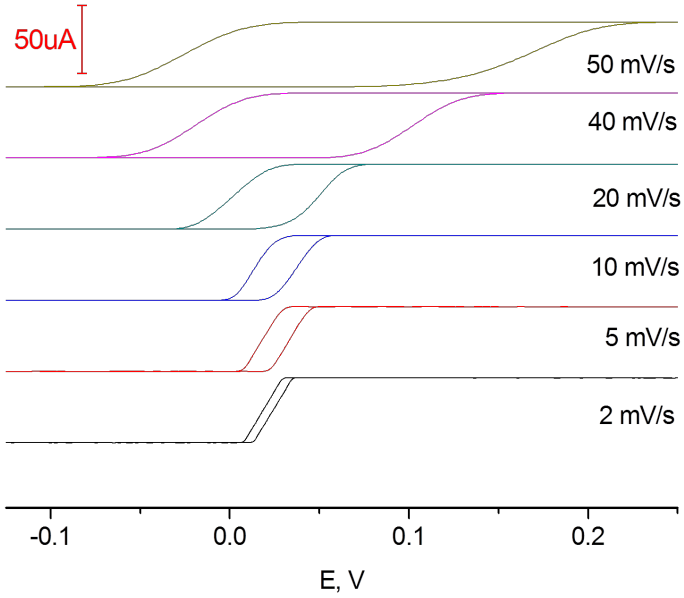

Figure 4: Voltammogram of water hyacinth carbon electrode in $K_2C_2O_4$ 4M and various scan rate.

Figure 5 shows the differences of voltammogram before and after the addition of surface active agent, triethanolamine (TEA). Voltammogram area of water hyacinth carbon electrode in $NaHCO_3$ and KOH are relatively the same before and after the addition of TEA but slightly shift to cathodic current. The situation is relatvely different if electrode was in H_2SO_4, whereas voltammogram area become narrower with addition of TEA, meaning that the capacitance of the electrode increased.

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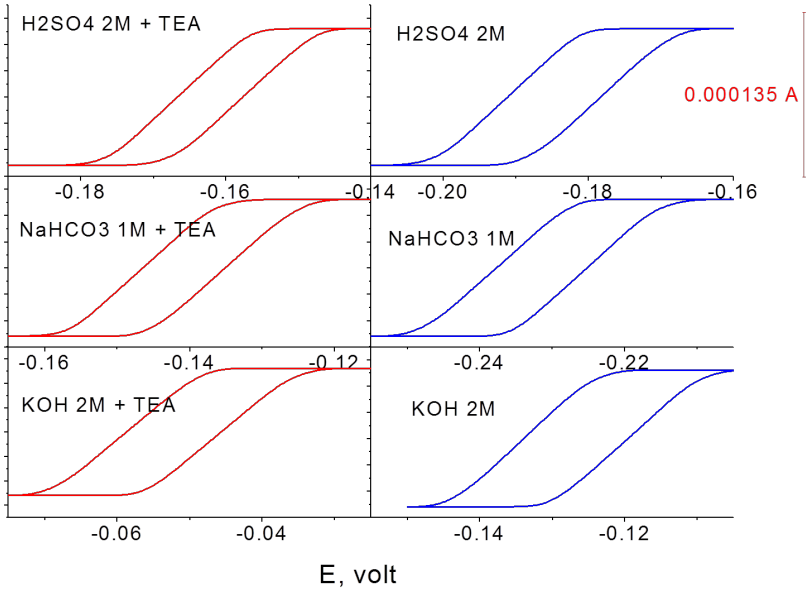

Figure 5: Voltammogram of water hyacinth carbon electrode in acid, base, salt electrolyte with and without TEA.

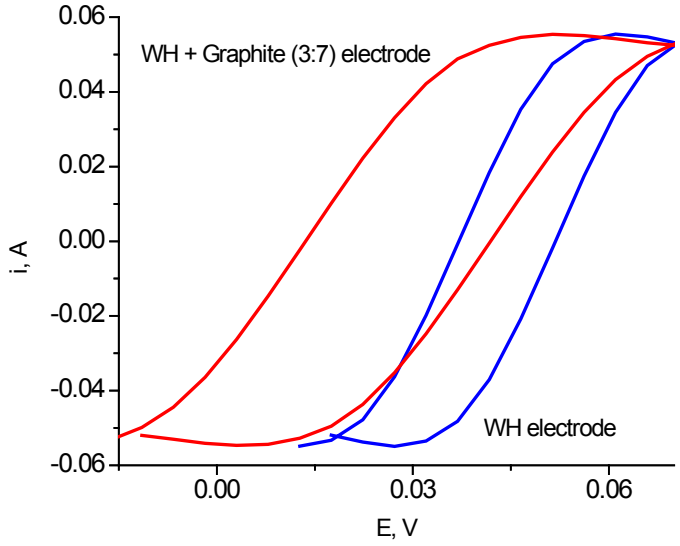

Figure 6: Voltammogram of water hyacinth (WH) carbon and WH + graphite electrodes in $K_2C_2O_4$ 1M. WH and WH + graphite electrodes were made from the mixtures of the materials and epoxy resin, respectively.

The capacitance of WH electrode was lower than WH + graphite electrode. The calculation of the voltammograms values in Figure 6 were performed using equation (1) revealed that the WH + graphite (3:7) and WH electrodes have 0.201 and 0.026 Fg^{-1} of capacitance, respectively. Therefore, the magnitude of capacitance reduced 10 times after whole graphite was changed to WH's carbon materials due to the reducing in graphitic carbon in electrode.

4. Conclusion

Hydrothermal assisted microwave pyrolysis of water hyacinth produced high crystallite material graphitic containing carbon (47%) and KCl, sylvite (20%) as revealed on EDX analysis. SEM image and XRD difractogram confirmed a few quantity of carbon nanoparticles and relatively large crystallite of KCl. The electrical conductivity value (0.001 – 1.5 Scm^{-1}) of carbon was complied with the category of carbon conductivity produced from biomass pyrolysis. Non-faradaic process of carbon composite was detected over voltammogram on all samples, which indicated the capability to carry capacitive process. The technique and the raw material used in this research should become green approach for making electrode material.

5. Acknowledgements

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Group Technology Paves the Road for Automation

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ABSTRACT

Group technology (GT) has traditionally been a manufacturing philosophy in which parts are identified and grouped together to take advantage of their similarities in manufacturing and design. Similar parts are arranged into part families. In manufacturing, since each family possesses similar manufacturing characteristics, the processing of each member of a family is similar. This study illustrates the important role that GT plays in design of an automated manufacturing system. This is accomplished by creating an ideal application of GT to automation with manufacturing machine cells and part families based upon the design and manufacturing process. In this GT scheme, each machine cell takes care of an individual part family and is independent of rest of the system. Manufacturing cells that process such part families have fewer challenges to automation than cells that process parts without any grouping.

1. Introduction

Group Technology (GT) is a manufacturing philosophy in which the parts having similarities (i.e. design geometry, manufacturing process, function) are grouped together to achieve a higher level of integration between design and manufacturing functions (Rajput,

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2007). GT-based manufacturing systems have been found to be particularly appropriate for discrete part manufacturing since they provide some of the strategic benefits of job shops, such as product customization, and simultaneously provide some of the operational benefits of the line process such as reduced WIP inventories (Luong, *et al.,* 2001). The idea behind GT is the decomposition of a manufacturing system into subsystems (Kusiak, 1987). This makes GT is a strong reinforcement for cellular manufacturing and other areas of lean manufacturing.

There are, however other advantages to utilizing GT in advanced manufacturing technologies. For example, since it makes use of similarities in design and manufacturing attributes, GT greatly contributes to a more efficient integration of CAD and CAM to the product design, process design and process planning phases. This paper demonstrates the implementation of Group Technology as a foundation for the successful implementation of automation. This includes some examples of GT coding systems, as well as the applicability of GT to automation.

2. Implementing Group Technology

There are two major tasks that a company must undertake when it implements Group Technology: identifying the part family, and rearranging production machines and workstations into cells. Neural networks have been used in GT systems for classifying and coding parts. Schemes have been developed to group parts based on the shape similarity attribute using neural networks (Kaparthi and Suresh 1991). Neural networks allow computer systems to utilize algorithms to quickly identify groups among large numbers of parts, much more accurately and quickly than their human counterparts. This also is good for standardization of grouping attributes, which can be updated and parts re-grouped as necessary.

Part families are a collection of parts that are similar, either because of geometric shape and size or because similar processing steps are required in their manufacturing. The parts within the family will have some differences, but their similarities are close enough to where they would share similar manufacturing processes. These parts can therefore be grouped together according to their machining sequences.

3. Grouping Part Families

There are several methods for solving part families grouping, each of which has its own advantages and disadvantages. All require time-consuming analysis of extensive data by properly trained employees, while some can be facilitated using computer applications. Three major methods are (Suresh and Kay, 1998):

1) Visual or Intuitive Approaches
2) Classification and Coding Systems
3) Production Flow Analysis (PFA)

3.1 Visual Approaches

Visual Inspection method is the least sophisticated and least expensive method. It is also known as the intuitive or judgment method, as it requires intuition and judgment of an engineer that is very familiar with the production system. Eyeball techniques work for restaurants, but not in large job shops where the number of components may approach 10,000 and the number of machines 300 to 500 (Black, 1991). It involves the classification of parts into families by looking at the physical parts or their photographs and arranging them into groups which have similar features. Experienced engineers may be successful with an intuitive visual method, but this can be time-consuming and will very likely not lead to the most effective group method.

3.2 Classification and Coding Systems

The classification and coding grouping method is usually considered to be the most powerful and reliable method, and can be tailored to fit any situation (Kamrani and Salhieh, 2002). Thus, there are numerous commercial and non-proprietary classification and coding systems available and in development (Tatikonda and Wemmerlöv, 1992). Part classification and coding systems refers to the process of assigning codes to parts. Digits, symbols, and/or letters represent the attributes of the parts which are used to form the families of parts with similar attributes. The coding system determines the sequence of these digits and how codes are assigned to parts based upon attributes. The following are benefits of classification and coding systems:

- Facilitation of the formation of part families and manufacturing cells
- Quick retrieval of designs, drawings and process plans
- Reduced design duplication

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- Faster design improvements and implementation
- Accurate estimation of machine tool requirements and logical machine loading
- Rationalization, improvement and standardization in tool and fixture design
- More accurate cost estimation
- Reliable work piece and process statistics

Classification and coding systems involve part definitions being decoded through digits to make the classification distribution automatic and controlled. A well-implemented classification and coding system would therefore be beneficial as part of a computer integrated manufacturing system. The three basic coding structures are (Radhakrishnan, *et al.,* 2000):

- Chain type coding (polycodes)
- Hierarchical coding (monocode)
- Hybrid coding (mixed or decision-free coding)

In chain type coding, or polycoding, each digit has its own interpretation which is independent of the preceding digits. As shown in the example chain structure in Figure 1, each code character represents a distinct piece of information of a particular part or product. Chain codes are compact and are relatively easy to construct and use compared with the other coding structures. However, chain codes cannot be as detailed as hierarchical structures with the same number of code digits.

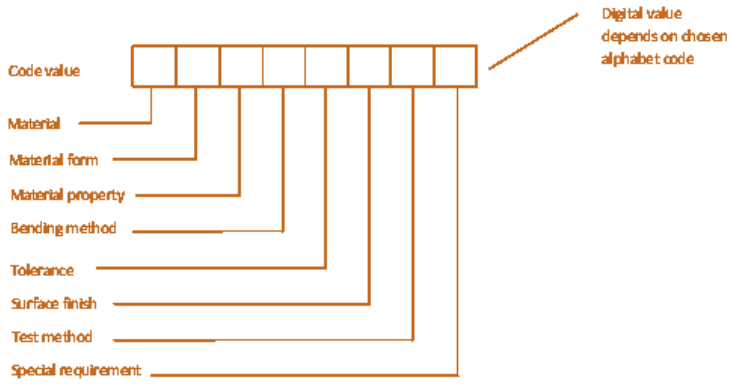

Figure 1: Chain type coding example.

In Hierarchical coding, or monocoding, the meaning of each code character depends upon the preceding characters. As shown in the example in Figure 2, the interpretation of each symbol depends upon the value of the preceding symbol; symbols are usually in digits..

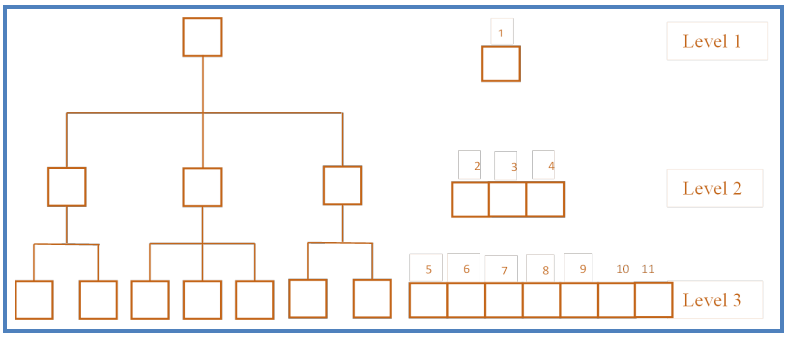

Figure 2: Hierarchical coding example.

Hybrid codes are typically a combination of hierarchical and chain type structures. Hybrid code retains the advantage of both the systems. The example in Figure 3 is a hybrid code consisting of a 2-digit chain code (polycode), followed by a 3-digit hierarchal code (monocode), followed by another 2-digit chain code.

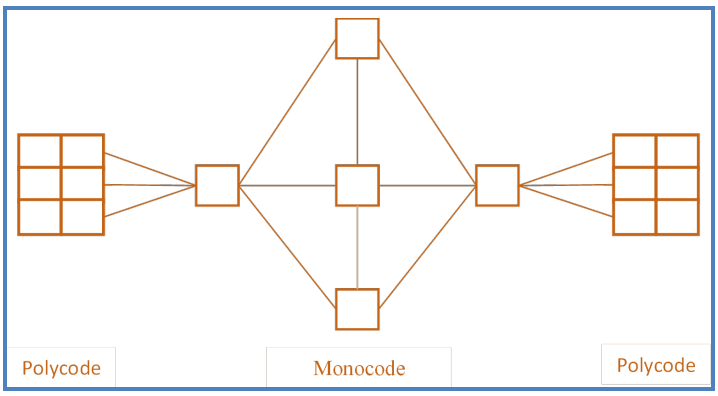

Figure 3: Hybrid coding example.

Due to the great flexibility of hybrid coding, most coding and classification systems use this code structure (Fuchs, 1988). Additionally, there exist some well-known and well-developed hybrid coding systems, such as the Opitz classification system. This classification system was inspired by Opitz, at the Technical University of Aachen, 1970. It is intended for machined parts and uses the following digits sequence (MacConnell, 1971):

1 2 3 4 "Form Code" or "Geometric Code" - describes primary design attributes

6 7 8 9 "Supplementary Code" - describes some of the manufacturing attributes

A B C D "Secondary Code" – optional code to describe production details.

3.3 Production Flow Analysis

Production flow analysis (PFA) is a method for identifying part families and associated machine groupings by using the information contained on process plans rather than on part

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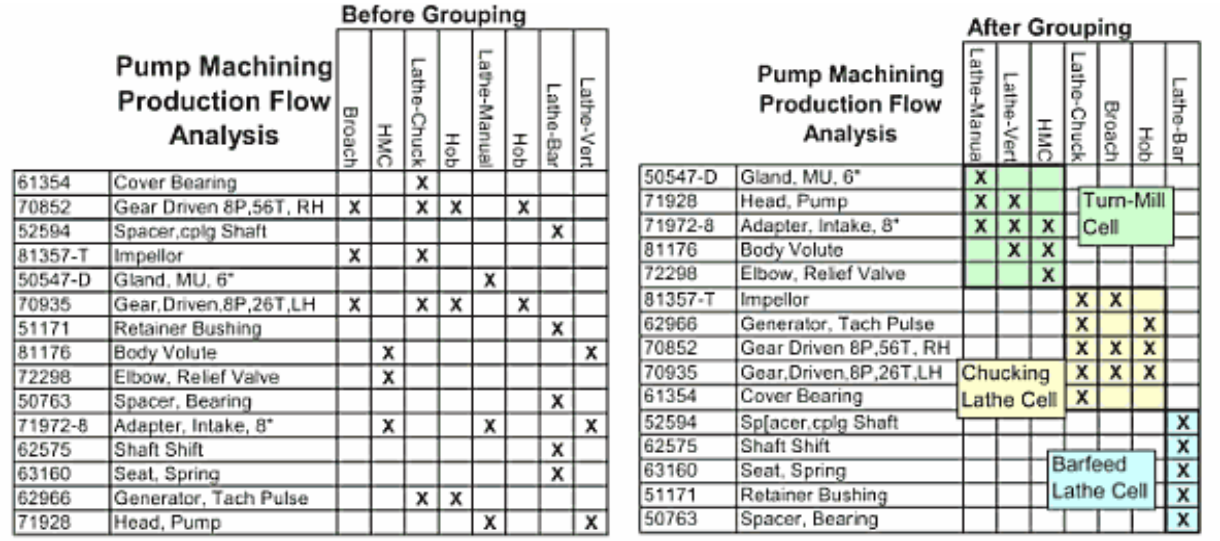
drawings. Work parts with identical or similar process plans are classified into part families. These families can then be used to form logical machine cells in group technology layout, as seen in Figure 4.



Before Grouping

Pump Machining Production Flow Analysis		Broach	HMC	Lathe-Chuck	Hob	Lathe-Manual	Hob	Lathe-Bar	Lathe-Vert
61354	Cover Bearing			X					
70852	Gear Driven 8P,56T, RH	X		X	X		X		
52594	Spacer,cplg Shaft							X	
81357-T	Impellor	X		X					
50547-D	Gland, MU, 6"					X			
70935	Gear,Driven,8P,26T,LH	X		X	X		X		
51171	Retainer Bushing							X	
81176	Body Volute		X						X
72298	Elbow, Relief Valve		X						
50763	Spacer, Bearing							X	
71972-8	Adapter, Intake, 8"		X			X			X
62575	Shaft Shift							X	
63160	Seat, Spring							X	
62966	Generator, Tach Pulse			X	X				
71928	Head, Pump					X			X

After Grouping

Pump Machining Production Flow Analysis		Lathe-Manual	Lathe-Vert	HMC	Lathe-Chuck	Broach	Hob	Lathe-Bar
50547-D	Gland, MU, 6"	X						
71928	Head, Pump	X	X		Turn-Mill Cell			
71972-8	Adapter, Intake, 8"	X	X	X				
81176	Body Volute		X	X				
72298	Elbow, Relief Valve			X				
81357-T	Impellor				X	X		
62966	Generator, Tach Pulse				X		X	
70852	Gear Driven 8P,56T, RH				X	X	X	
70935	Gear,Driven,8P,26T,LH	Chucking Lathe Cell			X	X	X	
61354	Cover Bearing				X			
52594	Sp[acer,cplg Shaft							X
62575	Shaft Shift							X
63160	Seat, Spring			Barfeed Lathe Cell				X
51171	Retainer Bushing							X
50763	Spacer, Bearing							X

Figure 4: PFA uses the information in the route sheets to suggest new product grouping.

In PFA, parts that go through common operations that are grouped into part families. The machine used to perform these common operations may be grouped as a cell; consequently this technique can be used in facility layout or value stream mapping (Lee and Snyder, 2006). PFA as a GT grouping scheme uses a matrix of part numbers to group families. This method is simple, cheap, and fast, but more analytical than tactical judgment (Black, 1991). However, PFA can become cumbersome if the product mix is more than 100 items (Lee and Snyder, 2006). The procedure for PFA consists of following steps:

1. Data Collection – the minimum data needed are part numbers (or another part identification code) and operation sequences obtained from the process plan. Additional data, such as manpower assignment, time standards, batch sizes and annual production rates may also be useful for designing machine cells of a desired production capacity.

2. Sorting of process plans is used to group parts with identical process plans. One method to accomplish this step is to input the data collected into a data collection database.

3. Charting of the PFA for each group is then displayed graphically on a PFA chart as shown in Figure 5.

Machines	Parts A	B	C	D	E	F	G	H	I
1	1			1				1	
2					1				1
3			1		1				1
4		1				1			
5	1							1	
6			1						1
7		1				1	1		

Figure 5: Production Flow Analysis chart.

Machines	Parts C	E	I	A	D	H	F	G	B
1	1	1	1						
2		1	1						
3			1						
4				1	1	1			
5				1		1			
6							1	1	1
7							1		1

Figure 6: Clustering Analysis chart.

4. Clustering Analysis, which is an attempt to uncover and display similar clusters or groups in an input object-object or object– attribute data matrix, as seen in Figure 6. It is a technique to re-arrange rows and columns of the input matrix- typically a binary matrix that determines whether or not a part is processed on particular machine (Heragu, 2006).

4. Key Features for Successful GT Application

GT is not naturally a success in all production situations. The three basic features for a successful FT application include (Burbidge, 1975):

- Group layout
- Short cycle flow control
- Planned sequence of machine loading

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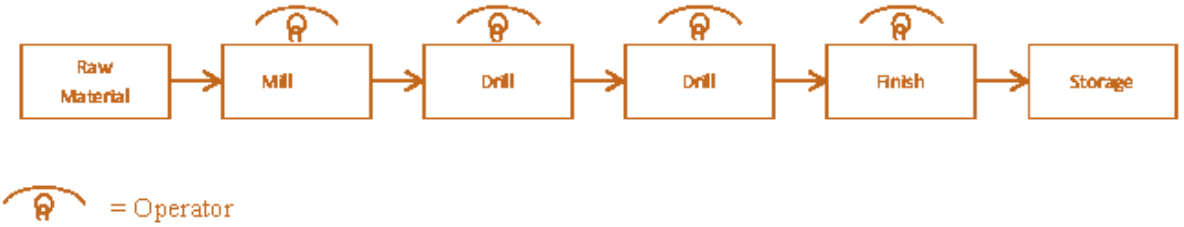

Figure 7: Schematic of dedicated flow line layout.

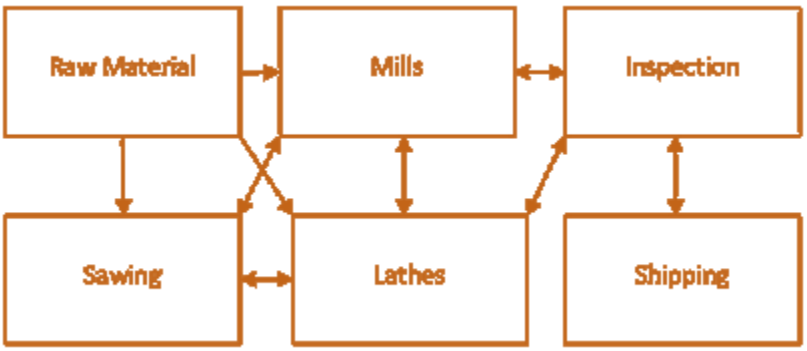

Figure 8: Schematic of a basic functional layout.

Group layout differs from the other two major types of layout – line layout and functional layout – in that group layout is completely based upon groups of parts. Line layout, depicted in Figure 7, is used for continuous assembly and mass production of components required in very large quantities. In line layout the machines are always used in same sequence, and the time an item spends at each station or location is fixed and equal (balanced) (Black, 1991). In a functional layout (see Figure 8), all machines of same type are laid out together in the same section under the same foreman (Schönsleben, 2007). Each supervisor and team of workers specializes in one process and work independently, which is why it is often called process specialization.

In most of today's factories it is possible to divide all manufactured components into families and all machine tools into groups, in such a way that all the parts in each family can be completely processed in one dedicated machine group or cell only. Group layout therefore involves each foreman and his/her team specializing in production of one list of parts and co-operating in the completion of common tasks. This type of layout is based on component specialization, and machine tools in each group need not be used in same sequence (Burbidge, 1973).

5. Application of Group Technology

The first step in quality control must be to control design, since a good design should make it possible for the product, to be manufactured by current equipment with a high level of quality maintained. This means that a good design should contribute something to increase quality while reducing costs. GT can be a tool to help designers reach these two conflicting goals.

Basically, the cluster algorithms of GT can be classified into two major classes. A design-oriented approach relies on the design features of parts to perform the necessary analysis. The production-oriented approach, on the other hand, is based on routing information to group parts or machine (Kroll and Wang, 1994).

The objectives or constraints under which the GT system design problem is typically tackled are as follows (Vakharia and Wemmerlöv, 1990):

- Minimize the intercellular materials handling cost (or maximize cell independence). A primary focus of GT is to identify cells where the between-cell interaction is restricted.
- Minimize investment in equipment. In reorganizing a job shop into a GT cell system, there is typically an increase in the number of machines required. Hence, this objective focuses on minimizing the additional investment in such equipment.
- Maintain acceptance equipment utilization levels. A cell system design is feasible if the utilization of equipment in each cell is less than the maximum acceptable level.
- Identify the cells of reasonable size. The size of the GT cell will impact how easily the cell can be managed and controlled. Hence cells identified should not contain more than a specified number of machines.

6. Benefits of GT Toward Automation

Since manufacturing costs are major determinants of ultimate product costs, it is not surprising that optimizing the manufacturing process by grouping parts together can produce a significant return on investment.

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By analyzing a part database, it is possible to identify groups of parts that are similar from manufacturing point of view. This requires a production-oriented grouping method, such as Opitz classification and coding or PFA (Modak, *et al.,* 2011). Having done that, the next step is standardization – by manufacturing engineers – of manufacturing processes for group of similar parts. This manufacturing standardization leads to a best practice approach to making parts, and provides the basis for work instructions to the shop floor.

The grouping of parts into families can then lead to the development of a new type of mass production and the introduction of mass production methods for those families of parts. The costs associated with classification and standardization therefore do not have to be applied to lot sizes of just a few parts; they can be given to families of parts that may run much larger numbers (Houtzeel, 2001). The following are some of the major benefits of GT:

- Faster implementation of design and process improvements
- Reduction of inventory (incoming, in-process and finished)
- Reduction in wait time
- Reduction in production planning effort
- Simplification of parts and their manufacturing processes
- Component standardization
- Reduction of overall production cost
- Higher accuracy of estimates
- Improvement in employee morale
- Improvement in space utilization
- Setup time reduction
- Higher productivity
- Improvement in quality
- Improvement in material flow

Utilizing GT captures certain advantages such as reduced setup times, reduced in-process inventories, improved product quality, shorter lead time, reduced tool requirements, improved productivity, and better overall control of operations. It is these benefits that allow GT to pave the road towards automation. For example, if there is a single family's flow of parts and/or products that is consistent and controlled, we can put in place a reliable and repeatable way of handling these materials via robotics and autonomous vision systems with pick-and place capabilities. This process will ensure that our incoming parts are being automatically

classified and distributed, then automatically taken and off-loaded to each part's designated manufacturing cell. The robotics and vision systems can then take over and handle the parts virtually by itself (with proper programming). These, as well as listed in Table 1, are just a few of many functions that are possible with an automated manufacturing system.

Table 1: Computer functions of an automated system.

Function	Description
Communication	Operators must get instructions from computer system when operating a manual workstation.
Download part programs	Computer-controlled machines have to get their instructions from programs which are downloadable.
Material Handling	To ensure efficiency, material handling and machine availability should be coordinated.
Production Schedule	Computer systems should monitor average cycle times and how many units are produced in one shift so proper scheduling can be a result.
Diagnose Failures	Equipment failures, spare parts, and maintenance must be monitored.
Safety	Systems must operate in a safe manner.
Quality Control	Detection and rejection of bad parts, acceptance of good parts.
Manage Operations	Monitoring overall performance of the manufacturing system.

7. Automated Group Technology

A highly automated GT machine cell consists of a group of processing stations (usually CNC machine tools), interconnected by an automated material handling and storage system, and controlled by an integrated computer system. Figure 9 depicts a simple automated manufacturing cell with two machine tools and a robotic parts handling system. If truly automated in accordance with the features listed in Table 1, this setup would be typical of a small automated GT work cell. This would be accomplished by following the principles of a Flexible Manufacturing System.

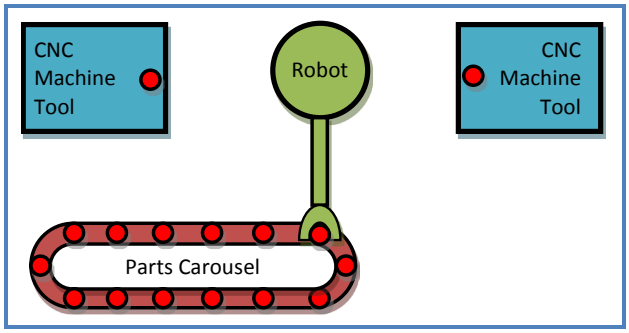

Figure 9: Automated manufacturing cell.

The Flexible Manufacturing System (FMS) operates in parallel with the principles of GT. No manufacturing system can produce an unlimited range of products, but a Flexible

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Manufacturing Cell (FMC) is capable of producing single part family or a limited range of part families. This flexibility is a key advantage of an FMC – the ability to cope with changes in part design, changes in production, equipment malfunctions, and variations within a part family. These principles – especially variation within a part family – imply common characteristics of GT and FMS.

Table 2: Typical functions of an FMS (Groover, 2010).

Function	Description
NC Programming	Development of NC programs for new parts introduced into system.
NC Program Download	NC part programs must be downloaded to individual stations as required for the product mix.
Production Control	Product mix, machine scheduling , and other planning functions.
Work-Part Control	Monitor status of each work-part in the system, status of pallet fixtures, orders on loading/unloading pallet fixtures.
Tool Management	Tool inventory control and queue location, tool status relative to expected tool life, tool changing and re-sharpening, and transport to and from tool sharpening/storage location.
Transport Control	Scheduling and control of work handling system.
System Management	Compiles management reports on performance (utilization, piece counts, production rates, etc.).

Looking back at the automated work cell in Figure 12, therefore, this cell could be set up as an FMC and allow for a single part family, not just a single part. This would be done by incorporating some of the basic FMS functions as applicable to this setup. Table 2 lists some of the common functions of an FMS. These functions indicate how an FMC is not only well-adapted, but would work ideally with a GT system (Kusiak, 1985).

8. Conclusion

This paper presents various approaches to Group Technology (GT), as well as the advantages of each. GT can be a gateway for automation because through production-oriented grouping, one can easily design work cells that are dedicated to single families and therefore easily created as FMCs. Furthermore, with GT, processes can be controlled, material handling can be controlled, inventory can be controlled more efficiently, flow of classified parts can be controlled, and with all the money that is saved by utilizing group technology, investments for automation can be made. This would include robotic arms and programmable logic controllers along with additional vision systems. So not only will distribution, classification along with inventory be automatically monitored and controlled, but the ability to pick and place these objects just by programming a robot with a vision system makes the system that much more autonomous. With these autonomous systems and a controlled manufacturing environment, the engineers and managers of a manufacturing system can grab the future by the horns and take it head on.

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Effect of Laser Priming on accumulation of Free Proline in Spring Durum Wheat (*Triticum turgidum* L.) under Salinity Stress

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ABSTRACT

Experiments were conducted during 2012 in a greenhouse of College of Abouraihan, University of Tehran, Iran. In this study the effects of salt stress and laser priming on proline content of durum wheat (*Triticum turgidum* L.) was carried out in a factorial experimental based on a randomizely complete block design (RCBD) with three replications. Seeds from two cultivars salt sensitive and salt tolerance of Durum wheat (*Triticum turgidum* L.) were exposed to neodymium-doped yttrium aluminum garnet (Nd-Yag) laser irradiation (75 mW cm^{-2}, radiated for 12 min). Salinity treatments carried out in four levels (Control, 70, 140 and 210 mM) via sodium chloride. The sampling from first leaves was carried out on four stages of growth and their proline content was measured. The result showed that free proline content in leaves increased significantly by increasing of NaCl concentration and salt tolerant variety accumulate more Proline than sensitive variety. Also proline content significantly increased with irradiation by laser beam in salinity condotion. These results indicate that the low power continuous wave Nd–Yag laser light seed treatment has considerable biological effects on plant metabolism. This seed treatment technique can be potentially employed to enhance agricultural productivity.

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1. Introduction

Environmental stresses negatively influence the plant growth, developmental stage and crops yield. Soil salinity is one of the major abiotic stresses adversely affects physiological and metabolic processes such as germination percentage, crop growth, productivity and photosynthesis in plants (Sairam *et al*., 2002). Soil salinity makes the change in plants in two ways. High concentration of salts in the soil makes it harder for roots to absorb water and leads to physiological drought, and in plant can be toxic by high concentration of Na^+. Another way is that the salts on the outside of roots have an immediate effect on cell growth and associated metabolism; toxic concentrations of salts take time to accumulate inside plants before they affect plant function (Khosh KholghSima *et al*., 2009; 2012). Because NaCl is the most soluble and widespread salt, it is not surprising that all plants have evolved mechanisms to regulate its accumulation and to select against it in favor of other nutrients commonly present in low concentrations, such as K^+ and NO_3^- (Munns, and Tester, 2008). If Na^+ and Cl^- are sequestered in the vacuole of a cell, organic solutes that are compatible with metabolic activity even at high concentrations (hence 'compatible solutes') must accumulate in the cytosol and organelles to balancethe osmotic pressure of the ions in the vacuole (Flower *et al*, 1977. Wyn Jones *et al*, 1977). The compounds that accumulate most commonly are sucrose, proline, and glycine betaine, although other molecules can accumulate to high concentrations in certain species (Hasegawa Pm *et al*, 2000. Munns, 2005), Production and accumulation of Free Amino Acids (FAA), especially proline by plant tissue during drought, salt and water stress is an adaptive response. This amino acid is widely believed to function as a protector or stabilizer of enzymes or membrane structure that are sensitive to dehydration or ionically induced damage such as Reactive Oxygen Species (ROS) and antioxidant defense. For the durum subspecies, high the level of free amino acids, especially proline in the leaf correlated well with salinity tolerance (simon-sarkadi et al, 2002). Durum wheat (*Triticum durum* Desf), which is used mainly for making pasta and macaroni is the second most important wheat, and is widely grown in Southern Europe and the Middle East, and on soils affected by salinity (Sadat Noori and McNeilly, 2000). Durum wheat compared with common bread wheat (*Triticum aestivum* L.) is known for its hardness, protein, intense yellow color, nutty flavor and excellent cooking qualities (Kneipp, 2008). Although durum wheat cultivars are more salt sensitive than bread wheat and their yield is lower under saline soils (Munns and James, 2003), for this reason breeding new cultivars of durum wheat capable of that can be grown on

saline soils is of great interest. Seed dressing with various growth regulators, plant hormones, fertilizers etc. are currently considered the most efficient; the best recognized and the most often used practice. However, such substances may modify the chemical structure of the treated seeds, pollute the soil and pose a great danger to the environment. Therefore, more attention has been paid to study physical factors that favorably improve cultivated plants (Perveen, R., et al. 2010). Many studies indicate that physical methods stimulate only changes at physiological and biochemical level in the treated seeds (Aladjadjiyan, 2007; Perveen *et al.* 2010) rendering them safe and friendly to the environment. Laser is considered one of the physical methods that can be safely applied to improve the quality and yield of crop plants (Inyushin, *et al*, 1981; Ivanova, 1998; Koper, 1994; Podleoeny, 2002). The aim of these methods is the appropriate preparation of the sowing material to improve seed sprouting growth and vigor (Podlesny, and Podlesna, 2004) The laser radiation has been used by different researches (Wilczek, *et al.* 2004; Chirkova, 2002; Podlesny, Podlesna, 2004) as a physical method to improve the germination, the growth and the vigor of seeds (Salyaev *et al*. 2007). Biophysical methods can stimulate the seed and plants, through improving the energy balance and hence activating the growth and yield processes (Chen *et al*., 2005; Vasilevski, 2003). However, biophysical protocols are beneficial that enable plants to vegetate at a higher energy level. It is now evident that physical methods such as laser radiation application enhance the energy account of metabolites by internal energy transformation (Chen, *et al*. 2005). Therefore; the aim of the present study was to investigate the effect of pre sowing laser treatment on the accumulations of free proline content under salinity stress.

2. Mathematical Model

Experiments were conducted during 2011 in a greenhouse of College of Abouraihan, University of Tehran, was carried out using a factorial (salinity, laser, cultivar) based on a completely randomized block design with three replications. Factors included four salinity levels (Control, 70, 140, 210 mM NaCl), two cultivars (*Triticum turgidum* L. cv. Karkheh and Dena) and two lasers level (irradiated seeds and Non-irradiated). Seeds from two cultivars salt sensitive (Karkheh) and salt tolerance (Dena) of Durum wheat (*Triticum turgidum var.*durum L.) were obtained from Seed and Plant Improvement Institute in Karaj, Iran. Primary the selection of seeds based on their sizes was carried out and irradiated with Neodymium-Yttrium-Alminum Garnet (Nd:YAG) laser (wavelength 532nm, power intensity 75 mW cm $^{-2}$

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and irradiation time for 12 minutes). The irradiated seeds sown in a 48 plastic pots that have Seven kilogram of soil composed of dried sandy loam with natural pH (pH=7.28). The pots were placed in a green house in semi-controlled conditions with a photoperiod of 16h light and 8h dark, relative humidity of 60%-75%. When seedling were in zadoks 21, salt stress treatments were imposed by adding 70, 140 and 210mM NaCl by adjustment the water content of soil to near the field capacity. The sampling from first leaves was carried out after 24 half, 3 days, 7 days and 15 days of each salinity level, then incubated in liquid nitrogen and maintained at -80°C until the measurement time.

The proline content was quantified according to Bates *et al*. (1973). Leaf samples (0.2–0.5 g of fresh weight) of frozen plant material were ground to a fine powder in a pre-cooled mortar with liquid nitrogen. The powder was homogenized in 5 mL of 3% aqueous sulfo-salicylic acid and centrifuged at 14000g for 2 minutes. Two mL of acid-ninhydrin and 2 mL of glacial acetic acid were mixed with 2 mL of the homogenate in a test tube. The mixture was incubated at 100^0C for an hour. Reaction was stopped by placing the test tube in an ice bath. Four mL of toluene were added to each test tube and vortexed for 15–20 seconds. The organic and inorganic phases were separated, and the absorbance at 520 nm of the organic toluene phase containing the chromophore was recorded with spectrophotometer (Perkin-Elmer, Lambda 25, USA). Concentrations of proline in plant tissue are expressed on a fresh weight basis and determined from a standard curve and calculated on a fresh weight basis as follows:

$$\mu\text{moles}\,\frac{\text{Proline}}{\text{g}}\,\text{of fresh weight material} = \frac{\left[\frac{\mu\text{g}\,\frac{\text{Proline}}{\text{ml}} \times \text{ml Toluene}}{115.5\mu\,\frac{\text{g}}{\mu\text{mole}}}\right]}{(\text{g sample}/5)} \qquad (1).$$

3. Statistical Analyses

Data were subjected to analysis of variance (ANOVA) using the general linear model of SAS (Statistical Analysis System V.9) program. The mean differences were compared by Duncan's test at the $P \leq 0.05$ and 0.01 levels.

4. Results and Discussion

The results of analysis variance of effects of laser pretreatment and salinity stress on proline accumulation were showed in Table 1. As we can see, the interaction effect of salinity

and laser on free proline content was significant in all steps on sampling ;containing 24h, 3days, 7days and 15 days after salinization (DAS).

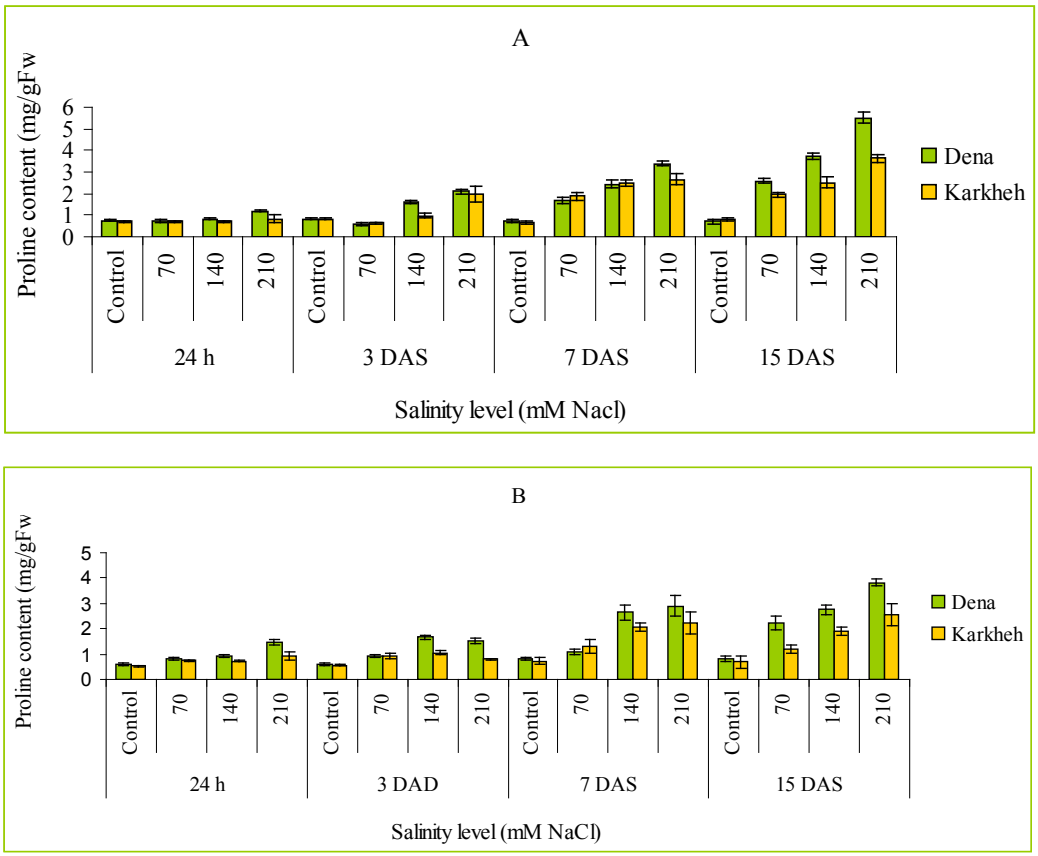

Figure 1: Effect of salinity levels on proline in durum wheat genotypes with Effect of Laser (A) and No Effect of Laser (B). Vertical bars indicate ± S.E. of mean (n=3). Data were significant at 5%probability level for days, salinity treatments and varieties.

Table 1: Analysis of variance for proline content of durum wheat (*Triticum turgidum* L.) was irradiated with laser under salinity conditions

Source of variation	df	Mean of squares			
		24h	3d	7d	15d
Replication	2	0.087**	0.192**	1.164**	0.76**
Variety	1	0.373**	0.850**	0.548**	8.97**
Salinity	3	0.440**	2.253**	10.209**	20.66**
Laser	1	0.012$^{n.s}$	0.394**	0.916**	5.69**
Variety × Salinity	3	0.107**	0.292**	0.426 **	1.25**
Variety × Laser	1	0.023$^{n.s}$	0.073$^{n.s}$	0.068$^{n.s}$	0.02$^{n.s}$
Salinity × Laser	3	0.065*	0.807**	0.274**	0.95**
Variety × Salinity × Laser	3	0.003$^{n.s}$	0.066$^{n.s}$	0.089$^{n.s}$	0.1$^{n.s}$
Error	30	0.016$^{n.s}$	0.029$^{n.s}$	0.07$^{n.s}$	0.07$^{n.s}$
C. V. (%)	--	16.53	18.59	19.69	15.18

*, **significant at 5% and 1%, respectively. ns = non-significant.

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Salinity caused an important increase in proline content in both genotypes. Proline content also increased very significantly at the 3th stage as compared to the 1st and 2nd stage and then marginally at the 4th stage in both cultivars. In both conditions, laser and No-laser, two genotypes had not significant differences at low solution of salinity (70 and 140 mM) in 24h after doing of salinity stress. This revealed that differences between studied genotypes based on proline content, are obvious only after some time and in higher solution of salinity. In present of laser and at 210 mM, 'Dena' showed more proline content than 'Karkheh' statistically at all stages except of 3days after doing of salinity stress (Figure 1.A). Maximum differences between two genotypes were observed at 210 mM NaCl concentrations at the last stage of sampling. Proline content in plant cells under salt stress is a universal phenomenon that can serve as an osmotic regulator (El-Sayed *et al*. 2007) and in widely documented in the cell pressure adjustment, detoxification of injurious ions and membrane stabilization in plants under salinity conditions (Ashraf and Foolad 2007). Proline has been shown to function as a molecular chaperone able to protect protein integrity and enhance the activities of different enzymes (La´ szlo´ Szabados and ArnouldSavoure´. 2009). In No-laser condition, differences between genotypes were more obvious at starting stages of sampling, 3days, in contrast to laser condition. In study of two genotypes that were not exposed to laser, it was resulted that proline content of 'Dena' was more than 'Karkheh' statistically in all levels of salinity at 7day and 15 day except 70 level of salinity at 7day (Figure 1.B). In the 3rd stage of sampling, differences between genotypes showed that at 140 and 210 mM NaCl 'Dena' had 22% and 23% more proline content, respectively, comprising to the control. In the 4th stage and 140 mM NaCl so 'Dena' had 30% more pro than 'Karkheh' and at the 210 mM concentration 32%. During our investigation, analysis of variance showed that with the increase of salinity irrigation, proline content increased; namely 210 mM NaCl induced the highest value and control sample had the minimum extent of proline content in two varieties (Figure 1). Effect of salinity to proline content in canola, rice and wheat was reported previously (Shamseddin-Saeid and Farahbakhsh, 2008; Azizpour *et al*. 2010; Hadi *et al*. 2007). Expression of the genes encoding cell wall proteins (proline-rich protein and extension) and cellulose synthesis was induced in barley roots by salt stress (Ueda et al. 2007). Enzymes of the ROS-scavenging glutathione-ascorbate cycle showed significantly lower activities in the p5cs1 mutants compared to wild type under salt stress suggesting that Pro accumulation is implicated in the control of either stability or activity of enzymes in the glutathione-ascorbate cycle (Sze´kely et al. 2008). There are some reports showing that pretreatment of seeds by

laser beams increased the quality and quantity of produced plants. According to Cwintal*et al*. (2010), presuming stimulation of seeds with laser light caused a significant increase in the content of specific proteins, phosphorus and molybdenum in dry matter of the plants, and a decrease in the content of crude fiber. In our research, laser priming caused a reduction of undesirable effects of salinity and an increase in the proline content of plants under both normal and stress conditions. With the comparison of proline content between control and plants irradiated with laser beam in the most of same salinity concentration, we observed that laser had a significant effect ($P < 0.001$) on proline content under salinity condition (Figure 2).

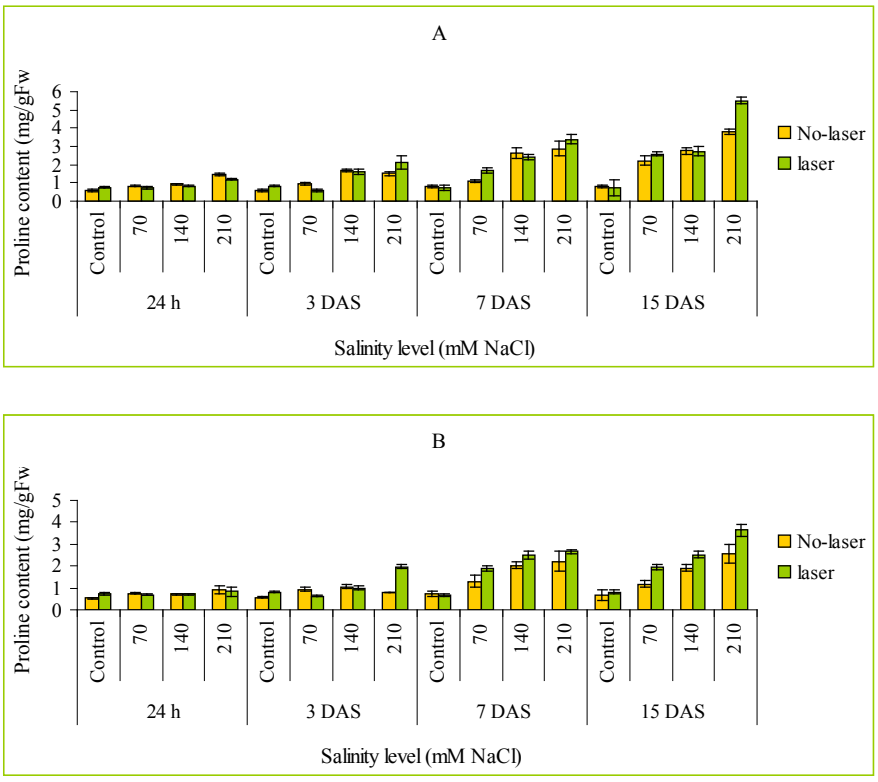

Figure 2: Effect of Laser Irradiation on proline content in durum wheat genotypes; salt tolerant (A) and salt sensetive(B). Vertical bars indicate±S.E. of mean (n=3). Data were significant at 5% probability level for days, salinity treatments and varieties.

As we can see on Figure 2A, there was not any significant difference between salinity levels at 24h stage in all salinity levels except of 70 mM. In Karkheh (a sensitive genotype), differences among using of laser and No-laser are completely visual in higher dose of salinity, especially after 7 days stage. In Dena (a tolerance genotype) and in 210 mM NaCl, using of

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laser increased the proline content statistically after 3days, 7days and 15 days of salinity stress doing, while it was reduced in 24 stage comprising to No-laser treatment (Figure 2.B). Also, using of laser in 140 mM NaCl of salinity was not change significantly the Dena's proline content in all stage except of 24h stage that it was reduced significantly in laser condition.

Proline was shown to protect Complex II of the mitochondrial electron transport chain during salt stress and therefore stabilized mitochondrial respiration (Hamilton et al, 2001).There are some reportes that shows laser pretreatment had a positive effect on proline accumulation in canola (Ashrafijou et al 2010) and common wheat (Sadat Noori et al, 2011) lead to increase salinity tolerance. One of the reasons for proline content increase can be the additional energy in plant at irradiation with laser beams. The laser Beam, as specific light, can be absorbed effectively through the macromolecules and cause some photochemical impacts (Xiang, 1995). In our research, the highest content of proline was observed in high salinity's stress, 210 mM NaCl, in Dena genotype that irradiated with laser, so proline content can a good choice for indirect selection in breeding programs for tolerance to salinity stress and also, the laser use can an alternative way for this purpose. It seems that the effects of salinity on plant growth and its osmolytes are not high in start stage of growth and sampling for examination of its effects on plants can be carry out on late period of plant's life cycle.

5. Conclusion

1. Increasing of the salinity, increases proline content and 210 mM NaCl induced the highest amount of this amino acid.
2. Salt Tolerant variety accumulates free proline content more than salt sensitive variety, so proline accumulation can be a useful parameter to breeding program for salinity tolerance.
3. Laser irradiation increased proline content in most of salinity levels and sampling steps.

The result showed that free proline content in leaves increased significantly by increasing of NaCl concentration and salt tolerant variety accumulate more Proline than sensitive variety. Also proline content significantly increased with irradiation by laser beam in salinity condotion. These results indicate that the low power continuous wave Nd–Yag laser light seed treatment has considerable biological effects on plant metabolism. This seed treatment technique can be potentially employed to enhance agricultural productivity. From this study,

stimulating effect of laser radiation can be used in wheat breeding and investigating the use of laser beam on other plants is recommended.

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Livable Public Open Space for Citizen's Quality of Life in Medan, Indonesia

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ABSTRACT

The decreasing of public open space quality by the urbanization pressure has declined its function as a 'free' place for people to do various activities which contribute to their quality of life. Among the typical cities' problems in developing countries, such as the poor environment quality, the social gap which becomes wider, the increasing of the gated community and the privatized public spaces, and the public open space which becomes more denying among the other development's priority, the research means to identify how livable public open spaces are and how its livability relates to the quality of life. The research found that the public open space in Medan city is a livable place when it has a high level of usage. The livable public open space relates to quality of life via the satisfaction with health, recreation and urban environment.

1 Introduction

The fast growing urbanization in most cities over the world gives impact to the changing of the urban environment. Some of general problems in the urban area are the decreasing of environment quality, the weakness of social cohesion and the economic gap which becomes wider. The economic expansion has turned urban land into an economical asset, and, one of the impacts is the depressing of public open space quality. The condition becomes a serious problem while the public open space has an important role for people quality of life. Physically, public open space is a green space where trees and vegetation grow and maintain urban

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ecology. Many researches show that the natural element of open space generates relaxation, which has a relation with mental health (Abraham, Sommerhalder and Abel, 2010). The open space becomes a place to do sports and many other physical activities to support physical health (Sugiyama, 2010; Franzini *et al,* 2009; Maller *et al*, 2009). In social aspect, public open space is a free access for people to enter in, to meet each other and to perform social interaction (Zhang, 2009). Public open space is a place to celebrate the cultural distinction (Thompson, 2002), so people could express their culture and tradition and discharging social boundary (Yeoh and Huang, 1998). The public open space could be a place for national events, community identity, and expressing an urban culture (Carr and Francis, 1992). The public open space also give a contribution to economic aspects while it could provide economic activities and enhance property's value (Irwin, 2002; Lutzenhisher and Netusil, 2001; Jim and Wendy, 2006, 2007).

There are several studies conducted to analyze the relationship between public open space and quality of life. Chiesura (2003) in Amsterdam found that public open space could affect quality of life through environmental, economic and social factors. Lynch (2007) in her study in Canada, stated that public open space influences quality of life through physical, social and psychological health, and also through economic and environmental quality. Commission for Architecture and Building Environment (CABE) Space in England argued that the relationship between public open space and quality of life is a complicated research to be held in national scale, but the smaller scale research has proofed that there is a correlation between the two (Beck, 2009).

With such important benefits to quality of life, now public open space in urban space over the world has to face some problems, such as the increasing of urban environments changing and the decreasing of public open space's function. Typical with the others, the cities in Indonesia are characterized by the fast growing shopping malls and gated communities which represent the middle up class' needs to a secure public space and global capital's movement (Dick and Remmer, 1998; Douglas, 2006). For example, in 2002, there were 20 malls built, although some of them were social-friendly, but only a little contributed to public space (Douglas, 2006). As a contrast, during this 30 years, public open space, especially green space, in Indonesian cities - such as Jakarta, Bandung, Medan, Surabaya and Semarang - tends to decline, from 35 % in 1970's to only less than 10 % in 2006 (Departemen Pekerjaan Umum, 2006).

Some of public open space problems in Indonesia are the privatization, commercialization

and control of public open spaces. In some cases, the condition is supported by local government and causes the increasing of social segmentation and security problems, the rise of exclusive groups and many other social problems (Turner, 2002; Atkinson, 2003). The trend to dismiss the public open space and the increasing of gated community has been a conflict in harmonious social life to be "the end of public culture" (Sennet, 1977; 1995). The circumstance is contrast with the normative concept of public open space as a place for social interaction, cultural integration, democratic expression and political harmony in urban life (Carr, 1992). Generally, the urban space quality is not only indicated by physical function, but also by the meet of social, culture, psychology and ideology needs (Rapuano & Wigginton, 1994), as the important parts of quality of life (Massam, 2002; Das, 2008).

The development is aimed to enhance and maintain the people's quality of life. In developing countries like Indonesia, where the planning and design of public open space does not have an important place among the development's priorities, it is critical to understand the people's perception about the place and whether it would relate to their quality of life. Thus, it would give contribution to development policy to reach the goal.

2 Methodology

The study located in Medan, the thirrd biggest city in Indonesia. The city of more than 2.5 million citizens had just less than 5 % public open space with a low quality. In the other side, malls, cafes and theme parks grew fast in this city, as well as gated communities. The research tried to investigate, whether the public open space relate to the quality of ife of citizens.

The survey was conducted in 2011. There were two types of data collected. The first, the physical and activity aspects of public open space, collected through the field survey and observation. The data gives information about the quality of public open space and how livable they are used. The second, the people's perception of public open space, collected through the interview based on a questionnaire. The respondents were people which were doing their activities in public open space. They were chosen randomly in every activity zones in four active public open spaces in Medan. Respondents filled a set of questionnaire, guided by interviewer. The questionnaire consists of several sections as follows: (1) the respondents' profile; (2) the perception about the relationship between public open space and several quality of life factors; (3) the characteristic of activities done in the public open space (4) the level of satisfaction of physical, social and management factors of the public open space (5) the level of

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satisfaction with quality of life factors. The level of satisfaction of public open space is measured in a five-point Likert scale ranging from "1" for very unsatisfied, "2" for unsatisfied, "3" for neutral, "4" for satisfied and "5" for very satisfied. Using the mean values of the scale, "3" is considered to be the midpoint. Thus, any value above 3 is considered somewhat satisfied but of higher level. Similarly with any value below 3, it is considered to unsatisfied but of lower level. The analysis of the public open space' level of usage is supported by descriptive statistics analysis, to describe people's socio-economic background, duration, frequency and the variation of activities. To identify the dominant factors of public open space from people's perception, the central tendency test and factors analysis is used. Next, Spearman correlation is used to analyze the relationship between perception about public open space and the quality of life.

3 Findings and Discussion

3.1 The liveability and people perception of public open space

The successful and liveability of public open space can be identified through two indicators, such as (1) users and (2) activity. From 'users' aspect, public open space was visited by all socio economic status, but dominated by the low income people (67.4%). Public open space was also visited by all age group, from kids to elderly, dominated by the teenagers (56.8 %).

In 'activity' aspect, it can be said that public open spaces in Medan were used optimally, both by the active and passive activities. There were a wide range of activities occur there, such as various sports, playing, picnicking, or just sitting and enjoying the environment. The most activities done were many kinds of sport, both in an organized or informal way, such as football, volley ball, gym and fitness, badminton, wall-climbing, jogging or just walking. The activities were supported by the public open spaces' facilities, although not always in a good quality.

The other indicator of the livability of public open space is the intensity of usage. Most people came to the public open space at least 1-4 times a month, while a part of them came more than once a week. People stayed in public open space for 1- 3 hours. Most of them came in the morning, between 05.00 to 10.00 am, and in the afternoon between 04.00 to 06.00 pm. Most people which doing their activities in public open space were those who spent their holiday and weekend in the public open space (53.9 %). The facts indicate that the public open spaces were

active and livable. It means that they had a high level of usage, although not reach '24 hours usage a day' criteria.

There were several factors of public open space perceived by people, such as the accessibility, facility, natural environment's elements, activity, management and the intensity of usage. The statistical analysis results show that, except the accessibility, all factors were significant in generating the perception about public open space (*see* Table 1)

Table 1: Factor analysis for the public open spaces factors

Factor name and items	Factor loadings	Eigenvalue	% Of variance	Cum %
Factor : public open space		9.647	6.398	75.24
Accessibility	0.33			
Facility	0.64			
Activity	0.67			
Management	0.58			
Natural environment	0.66			
Intensity	0.63			

The factor analysis shows that the '*activity'* has the highest loading factors, when the 'accessibility' has the lowest one. The activity, as an important factor in perceived public open space confirm the other study, such as Gehl (1996) which said that the function and activity will attract people coming to public open space. Generally, the most activities done is the optional activities as classified by Gehl (1996). It means most people do the recreational activities, as a kind of activities which relate to the quality of public open space. The high quality public open space will attract people to come to public open space (Gehl, 1996). In Medan, the quality of public open spaces are not good enough compares to the nature of the successful public open space (Project for Public Space, 2000; CABE and DETR, 2001; Carr *et al,* 1992*;*Gehl, 1996) or to the people perception (see Table 2), which have not reach 4 (satisfied). But the people kept using them intensively and make them the livable public open spaces.

The finding of this research, that the accessibility is not significant in generating perceived public open space, is different with many studies which argued that the factor is a very important in public open space (Project for Public Space, 2000; CABE Space, 2010). It can be said that people perceived 'accessibility' as 'how easy to reach a place by vehicle', because there is no good quality linkage or pedestrian in public open space, there is no integration with public transportation, too. But, people keep coming, and most of them (47.9%) use their motor cycles.

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Table 2: Satisfaction with Public Open Space's Factors.

Number	Factor of POS	Mean Score
1	Accessibility	
	Distance	2.7
	How easy to enter in	2.82
	How easy to acces it from home	2.92
2	Facility	
	Dimension	3.05
	Parking lot	3.05
	Public toilet	3.06
	Playing area	3.15
	Sport area	3.23
	Sitting area	3.28
	Praying area	3.18
	Eating area	3.28
	Street vendor	3.27
3	Management	
	Safety	3.12
	Cleanliness	3.22
	Attractivity	3.30
	Orderliness	3.36
	Management	3.36
4	Natural elements	
	Trees	3.72
	Garden	3.53
5	Function/actvity	
	Recreation	3.21
	Sport	3.23
	Social ineraction	3.27
	Politic/democracy activity	3.23
6	Intensity	
	Duration	3.08
	Frequency	3.38
	Variation of Activity	3.52

3.2 People Perception with Quality of Life Factors

Among many quality of life factors, some relate to people's activities in the public open space, such as the physical and psychological health (which relate to relaxation, recreation and social interaction) and the quality of urban environment - where public open space is one of the urban space elements (Sirgy and Cornwell, 2002; Salleh, 2008). Thus, the research analyzes the relationship between public open space and the three factors of quality of life, such as health, recreation and urban environment. This study found that, generally, almost people stated that they were satisfied with health, recreation and urban environment. But, it has to be highlighted that the majority of respondents were low income people. The people's subjective statements,

which they were satisfied with their quality of life, show that there is a difference between the objective and subjective quality of life. The fact supports what Hoornweg *et al* (2007) argued that, in developing countries, people's wellbeing do not always fit with the objective condition of the economic environment, so that, the measuring of quality of life is lead to the subjective measurement which is based on the individual personal perception.

3.3 The Relationship Between People's Perception of Public Open Space and Quality of Life

The quality of life in urban space is the outcome of the interaction between human and the urban environment. The satisfaction with public open space is one of the urban environment satisfaction indicators, so it relates to the level of satisfaction with the overall quality of life. The research builds a concept that people's perception of public open space has a relationship with quality of life via three factors: health, recreation and urban environment.

3.3.1 Public Open Space and Health

The health benefit of public open space is delivered through the activities done in the public open space, as well as the existing of public open space physical elements. The public open spaces in Medan are successful in accommodating many kinds of physical activity, such as various sports and play. The activities are perceived well by people with the mean score of the satisfaction level is between 'neutral' (score 3) and 'satisfied' (score 4)(see Table 2). Although the mean score did not reach 4 (satisfied), but the sum of people who said 'satisfied' (score 4) and 'very satisfied' (score 5) is larger than those who said 'unsatisfied' (score 2) or 'very unsatisfied' (score 1). The research found that the most activities has been done in a group, both family or friends group. It means that there is a big opportunity for people to perform social contact. The research shows that generally people have perceived social activity well. Most people said that they ever engaged in a social interaction, such as saying hello to or making a conversation with the stranger or other people they met in the public open space. The fact indicates that public open space could have accommodated social interaction well. The met of this need would relate to the psychological health of people.

The health benefit is also given by the natural elements of public open space, such as trees, garden and vegetation. The livable public open space means that people keep coming to the public open space, so there is a big opportunity to them to contact with natural environment. This condition would give a restoration and relaxation effect (Kaplan and Kaplan 1989, 1990;

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Ulrich, 1979) which, afterward, would affect their mental and psychological health. The result of the study shows that majority of people (86.2 %) believed that public open space affect positively to their physical and psychological health. The fact is also supported by their level of satisfaction that most people stated 'neutral' (41.4 %) and 'satisfied' (38.7 %), with the percentage of these levels of satisfaction was larger than the 'unsatisfied' and 'very unsatisfied' level. It means that generally people were satisfied with their health, but have not reach an ideal condition yet.

Table 3: The Correlation Test Result between Quality Of Life and Public Open Space

Descriptive Statistics

	Mean	Std. Deviation	N	
Quality of life	3.4080	.65675	384	
Public Open Space	3.2649	.51527	384	

Correlations

			Quality of Life	Public Open Space
Spearman's rho	Quality of Life	Correlation Coefficient	1.000	.231
		Sig. (2-tailed)	.	.000
		N	384	384
	Public Open Space	Correlation Coefficient	.231	1.000
		Sig. (2-tailed)	.000	.
		N	384	384

** *Correlation is significant at the .01 level (2-tailed).*

3.3.2 Public Open Space and Recreation

The met of recreation need is one of the quality of life indicators (Boyer and Savagean, 1981, 2000; Marlin, 1982). The level of people satisfaction with recreation activities in public open space shows mean score 3.21, or lower than 'satisfied' (mean score 4). But, the other sides, the public open spaces in Medan were active and livable. People have done many recreation activities, such as playing, picnicking, or just sitting. It means people have a big opportunity in gaining the benefits of recreation, such as a relaxation and restoration.

3.3.3 Public Open Space and Urban Environment

According to Das (20080), the quality of life in urban space is the outcome of the interaction between human and the urban environment. The public open space is one of the important urban environment elements. The study shows that, generally, the level of people

satisfaction with urban environment is 'neutral' (44.3 %) and 'satisfied', with the percentage of these levels of satisfaction was larger than 'unsatisfied' and 'very unsatisfied' level. It means that generally people were satisfied with the urban environment, but have not reach an ideal condition yet.

Table 3 shows the result of the correlation test between public open space and the quality of life. According to the table, it can be seen that the correlation coefficient between public open space and the quality of life is 0.231 or 23.1 %. It means public open space can explain quality of life as high as 23.1 %, and the rest explained by the other factors. It is because the quality of life factors of the study only those that relate to the activities in public open space, meanwhile there are many others quality of life factors. The positive direction of the relationship indicates that the increasing of satisfaction with the public open space will increase the satisfaction with the quality of life.

4 Conclusion

However, the quality of life is a complex concept, when there are so many factors relate to it. The research confirms many earlier studies that the livable public open space has a strong relationship with the citizen's quality of life, such as studies conducted by Quintas and Curado (2009), CABE Space (2010) and Lynch (2007). But it has to be understood that people have to face the changing of the lifestyle (Siu, 2008), the community and the way of recreation (Freestone and Nichols, 2004). The fact shows that the public open space has to compete with the higher quality privatized public space. The study found that physical factors of public open space have a strong correlation with the public open space perception. Thus, the enhancement of the public open space factors will make a better perception of public open space and then to the quality of life. The urban planning policy has to place the public open as one of the development priorities, because of the important contribution to the urban quality of life.

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