GREEN CHOICE PHILIPPINES

NELP-GCP 20170035
PLASTIC FURNITURE

I. BACKGROUND

There are different types of plastics that can be made into molded furniture. According to Connect Furniture Blog, some of the types of plastic that are used in making heavy duty plastic furniture include:

a) Polypropylene (PP) which is a fairly strong and durable plastic with a high melting point. It is also very easy to add color to this type of plastic which lends itself to the wide variety of colors available in plastic furniture.
b) Polyethylene (PE) which is available in a range of flexibilities and other properties depending on the production process, with high density materials being the most rigid. Polyethylene can be formed by a wide variety of thermoplastic processing methods and is particularly useful where moisture resistance and low cost are required.
c) Polyvinyl chloride (PVC) which has various applications in furniture from synthetic rattans to alternative leather. PVC is very popular for heavy duty use such as in commercial applications or even children's furniture. It's resistance to water is one of the advantages of PVC and a great reason to use it in children's furniture. The main downside to PVC is its lower resistance to sunlight meaning it is best to keep PVC products out of direct sunlight.
d) Polycarbonate (PC) which is one of the strongest types of plastic available making it great for furniture. Entire pieces of furniture can be moulded from polycarbonate including the legs, while still maintaining a reasonable amount of strength.
e) Nylon is a reasonably strong material and has been used in many industrial applications. It can also be made clear which makes it perfect for use in translucent furniture design. One downside to nylon is its very low resistance to heat and therefore it is best kept away from any sources of heat.
f) Polystyrene (PS) is another type of thermoplastic that is more lightweight, but is water resistant and stain resistant.

All of the above mentioned plastic types used for furniture are thermoplastics and can all be re-melted and remolded.

All types of plastic products are classified within the plastic industry as being either a durable or non-durable plastic good. These classifications are used to refer to a product's expected life. Products with a useful life of three years or more are referred to as durables. They include appliances, furniture, consumer electronics, automobiles, and building and construction materials. Products with a useful life of less than three years are generally referred to as non-durables. Common applications include packaging, trash bags, cups, eating utensils, sporting and recreational equipment, toys, medical devices and disposable diapers.

A. MARKET DESCRIPTION

The manufacture of plastic furniture is classified under the general category of manufacture of furniture. There is also a separate general category for plastic manufacturing (which the manufacture of plastic furniture does not fall under). The plastics industry refers to plastic fabricators and manufacturers which convert plastic resins to industrial and consumer finished

products. The plastic furniture is more domestically oriented. Most plastic furniture manufactured in the Philippines are sold locally, with only 7% directly exported. Ninety five percent of establishments in the furniture industry are small and medium enterprises (SMEs) and they are primarily concentrated in Metro Manila, Pampanga and Cebu. It is expected that this sector will continue to grow as the property market continue to strengthen.

Plastic furniture complements the current government initiative on engineered bamboo as a replacement for wood-based school furniture. They are considered cheap compared to designer furniture and reduces the reliance on wood.

Table 1 compares statistical indicators for the manufacture of plastic furniture for 2010 and 2013. It's a very small industry in terms of number of establishments and employees; however, it is growing significantly.

Table 1 PSA Statistical Indicators for the Manufacture of Plastic Furniture for 2010 and 2013

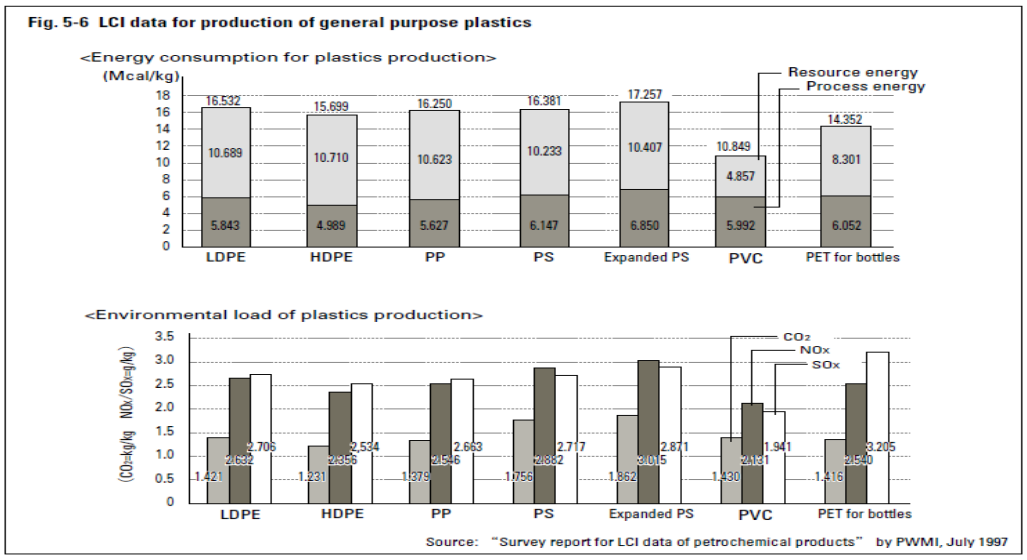
Statistical Indicator	2010	2013
Number of Establishments	12	19
Number of Employees	534	813
Value of Output (billions PHP)	0.7	1.3
Value Added (billions PHP)	0.2	0.3

B. ENVIRONMENTAL IMPACTS

While plastic furniture lasts for a long time, it has the potential to contribute to the solid wastes if they are not recycled. The following table presents the resin codes for different plastics. All the plastic types mentioned below are recyclable.

Plastic Type	**Recycling Code**
Polyethylene Terephthalate (PET)	1
High Density Polyethylene (HDPE)	2
Polyvinyl Chloride (PVC)	3
Low Density Polyethylene (LDPE)	4
Polypropylene (PP)	5
Polystyrene (PS)	6
Others (Other plastics, such as acrylic, nylon, polycarbonate, and polylactic acid (a bioplastic), and multilayer combinations of different plastics)	7

The following Tables were taken from the PVC Fact Book by the Vinyl Environmental Council of Japan and presents the energy consumption and environmental load of some plastic types based on life cycle inventory studies conducted in Japan.



Possible environmental initiatives would be to produce plastic furniture using a certain percentage of recycled plastics to ultimately reduce the amount of unusable or rejected plastic furniture being disposed through landfilling.

II. DEFINITION OF TERMS

Injection Molding- a manufacturing process for producing parts by injecting material (such as thermoplastic materials) into a mold.

Monobloc- made in one block or casting

Nylon- the generic name for all long-chain fiber-forming polyamides with recurring amide groups. Polyamides (Nylon) comprise the largest family of engineering plastics with a very wide range of applications. Polyamides (Nylons) are often formed into fibers and are used for monofilaments and yarns. Characteristically polyamides (nylons) are very resistant to wear and abrasion, have good mechanical properties even at elevated temperatures, have low permeability to gases and have good chemical resistance.

Plastics- a material that contains as an essential ingredient one or more organic polymeric substances of large molecular weight, is solid in its finished state, and, at some stage in its manufacture or processing into finished articles, can be shaped by flow. Rubber, textiles, adhesives, and paint, which may in some cases meet this definition, are not considered plastics.

Polycarbonate (PC) - this material is formed by a condensation polymerization resulting in a carbon atom that is bonded to three oxygen atoms. Applications of polycarbonate are almost always those which take advantage of its uniquely high impact strength and its exceptional clarity. These unique properties have resulted in applications such as bulletproof windows, break resistant lenses, compact discs, etc. More recently however, additional interest has resulted because of the low flammability of polycarbonate.

Polymer – a substance consisting of molecules characterized by the repetition (neglecting ends, branch junctions and other minor irregularities) of one or more types of monomeric units.

Polypropylene (PP)- readily formed by polymerizing propylene with suitable catalysts. Polypropylene properties vary according to molecular weight, method of production, and the copolymers involved. Generally polypropylene has demonstrated certain advantages in improved strength, stiffness and high temperature capability.

Polyethylene (PE)- tough, light, flexible synthetic resin made by polymerizing ethylene, chiefly used for plastic bags, food containers, and other packaging

Polyvinyl Chloride (PVC)- a tough, chemically resistant synthetic resin made by polymerizing vinyl chloride and used for a wide variety of products including pipes & fittings and building & construction materials, among others.

Recyclable – Characteristics of a product, packaging, or associated component that can be diverted from the waste stream through available processes and programmes and can be collected, processed, and returned to use in the form of raw materials or products.

Thermoplastic - soften when heated and become more fluid as additional heat is applied. The curing process is completely reversible as no chemical bonding takes place. This characteristic allows thermoplastics to be remolded and recycled without negatively affecting the material's physical properties.

Thermosetting polymer - resin that is thermally hardened (curing process) and never softened again. The resin contains polymers that cross-link together during the curing process to form an irreversible chemical bond.

III. SCOPE

These criteria are applicable to plastic furniture in which 95% by weight are made of plastic.

IV. GREEN CHOICE PHILIPPINES REQUIREMENTS

To carry the *Green Choice Philippines* seal, a product must meet the following requirements.

Criteria	Evaluation/Validation Method
A. Marking and Labeling	
1. The product shall be marked with an appropriate plastics resin identification code.	Visual inspection of actual product.
2. Labels/markings/stickers of the resin identification code must be made of the same material as the parts to which they are affixed. Any other marking and labelling shall not prohibit recycling. Labels and markings must be visible	Visual inspection of actual labels.
3. In case the raw material used is vinyl chloride monomer (VCM), it should be labelled with a sign stating, "DO NOT BURN"	Visual inspection of actual labels.
B. Raw Materials	
1. The plastic product shall contain at least 50% by weight of recycled plastic content, but must meet the relevant PNS' fitness for use (criteria C1).	Inspection of samples and on-site factory visit, documentation and certification.
C. Quality	
1. The manufacturer should conform to the most recent DTI-BPS standards on	Data from recognized testing and calibration laboratories accredited by the DTI-Philippine

<table>
<tr><th>Criteria</th><th>Evaluation/Validation Method</th></tr>
<tr><td>plastic (wherever applicable):

PNS ISO 19069-1 with Amd 1:2015 – Plastics – Polypropylene (PP) moulding and extrusion materials – Part 1: Designation system and basis for specifications ISO Published 2015 ICS 83.080.20
PNS ISO 1622-1 with Amd 1:2015 – Plastics – Polystyrene (PS) moulding and extrusion materials – Part 1: Designation system and basis for specification ISO Published 2012 ICS 83.080.20
PNS ISO 1872-1 Plastics -- Polyethylene (PE) moulding and extrusion materials -- Part 1: Designation system and basis for specifications
ISO Published 1993 ICS 83.080.20
PNS ISO 2086 - Furniture – Monobloc chairs for children has been developed as Philippine National Standard. It specifies the requirements for monobloc chairs for children and describes the test methods for determining the strength, durability and stability of monobloc chairs.</td><td>Accreditation Bureau showing conformity of the products with the specified property standards or the corresponding standards (Philippine National Standards) shall be submitted.</td></tr>
<tr><td colspan="2">D. Environmental Criteria</td></tr>
<tr><td>1. The applicant must meet all government regulations on safety, health and the environment</td><td>Applicant needs to submit compliance/self-monitoring reports regularly, at the same time they are submitted to DENR. The Mark may be revoked if the ecolabelling board finds out that it did not meet the regulations through available public information</td></tr>
<tr><td>2. Product should not contain the following:
a. Cadmium (Cd)
b. Lead (Pb)
c. hexavalent chromium (Cr^{+6})
d. mercury (Hg)
e. Tin (Sn)
f. polybromominated biphenyls (PBBs), polybromodiphenyl ethers (PBDEs) and short-chain (10-13 carbon atoms per molecule) chlorinated (chlorine content of greater than 50% by weight) paraffins</td><td>The applicant shall submit a portfolio and statement in writing signed by the Chief Executive Officer or counterpart of the company and shall be accompanied by the relevant documentations, including relevant laboratory test results.

Laboratory analysis methods are as follows.
<table>
<tr><th>Regulated Substance</th><th>Limit</th><th>Reference Test Method</th></tr>
<tr><td>Lead (Pb)</td><td><30 ppm</td><td rowspan="5">US EPA 3051A
US EPA 3050B
US EPA 3052
US EPA 3060A</td></tr>
<tr><td>Cadmium (Cd)</td><td><0.3 ppm</td></tr>
<tr><td>Tin (Sn)</td><td><30 ppm</td></tr>
<tr><td>Hg</td><td><2 ppm</td></tr>
<tr><td>Cr (Total)</td><td><30 ppm</td></tr>
<tr><td>PBBs, PBDEs</td><td><5 ppm</td><td>US EPA 3540C
US EPA 8081A
US EPA8082A</td></tr>
</table>
</td></tr>
</table>

Criteria	Evaluation/Validation Method		
			US EPA /8270D IEC 62321
	Short Chain Chloroparaffins	< 5 ppm	US EPA 8270D US EPA 3540C GC-MSD IEC 62321

V. PERIOD OF VALIDITY

The product criteria is valid for three years from the date of its approval unless otherwise revised or withdrawn by the NELP-GCP Board, if proven necessary at any period of time.

VI. REFERENCES

Abad, Jose Ramon A., 2008. Philippine Furniture Industry: Adjustments for the RP-US Trade Agreements [Online]. Available: http://www.dlsu.edu.ph/research/centers/cberd/pdf/papers/2008/WorkingPaper-2008-07-RPUSFTA-Abad.pdf

American Polymer Standards Corporation, 8 June 2017. Polycarbonate [Online]. Available: http://www.ampolymer.com/SDS/PolycarbonateSDS.html

American Polymer Standards Corporation, 8 June 2017. Nylon 6/6 [Online]. Available: http://www.ampolymer.com/SDS/Nylon6-6SDS.html

Bureau of Philippine Standards, 9 August 2015. PNS on Plastic [Online]. Available: http://www.bps.dti.gov.ph/index.php?option=com_docman&task=doc_details&gid=5833&tmpl=component&Itemid=99

Bureau of Philippine Standards, 23 October 2014. PNS on Plastic And Plastic Products [Online]. Available: http://www.bps.dti.gov.ph/index.php?option=com_docman&task=doc_details&gid=5385&tmpl=component&Itemid=77

Bureau of Philippine Standards, 25 June 2015. PNS on Plastic And Plastic Products [Online]. Available: http://www.bps.dti.gov.ph/index.php?option=com_docman&task=doc_details&gid=5262&tmpl=component&Itemid=77

Bureau of Philippine Standards, 31 July 2015. PNS on Plastic and Plastic Products [Online]. Available: http://www.bps.dti.gov.ph/index.php?option=com_docman&task=doc_details&gid=3707&tmpl=component&Itemid=77

Bureau of Product Standards, 4 June 2012. PNS on Monoblock Chairs for Children [Online]. Available: http://www.bps.dti.gov.ph/index.php?option=com_docman&task=doc_details&gid=1714&tmpl=component&Itemid=99

Bureau of Product Standards, 2 February 2012. PNS on Plastics [Online]. Available: http://bps.dti.gov.ph/index.php?option=com_docman&task=doc_details&gid=1146&tmpl=component&Itemid=101

Connect Furniture Blog, 12 September 2012. Plastic Furniture and the Various Types [Online]. Available: http://blog.connectfurniture.com.au/post/31368617858/plastic-furniture-and-the-various-types

Department of Trade and Industry, Board of Investments (Philippines). No date. Furniture [Online]. Available: http://industry.gov.ph/industry/furniture/

European Environmental Bureau, 30 June 2015. EU Ecolabel for Furniture: BEUC and EEB Comments to the Criteria Proposal April 2015 [Online]. Available: http://www.beuc.eu/publications/beuc-x-2015-083_bcu_eeb_and_beuc_comments_on_revision_of_eu_ecolabel_for_furniture.pdf

European Commission, 2017. JRC Science for Policy Report: Revision of EU Ecolabel Criteria for Furniture Products [Online]. Available: http://ec.europa.eu/environment/ecolabel/documents/technical_report_furniture.pdf

Furniturelink, 2014. Material science- Plastics [Online]. Available: http://www.furniturelinkca.com/plastics.htm

Green Council, 22 April 2010. Hong Kong Green Label Scheme Product Environmental Criteria for Plastic Products for Office Use (GL-002-004) [Online]. Available: http://www.greencouncil.org/eng/doc/GL002004_ver3.pdf

Hummel Croton, Inc. , No date. Polyvinyl Chloride Safety Data Sheet [Online]. Available: http://www.hummelcroton.com/msds/PVC.pdf

Japan Ecomark, 1 September 2005. Product Certification Criteria No. 118 for "Plastic Products Using Recycled Materials Version 2.0" (English Translation) [Online]. Available: https://www.ecomark.jp/english/pdf/11820eI.pdf

Hopewell, Jefferson; Dvorak, Robert; Kosior, Edward, 2009. Plastics Recycling: Challenges and Opportunities [Online]. Available: http://rstb.royalsocietypublishing.org/content/royptb/364/1526/2115.full.pdf

Mitsubishi Gas Chemical, 13 April 2015. MX Nylon (Nylon MXD6) [Online]. Available: http://www.mgc.co.jp/eng/products/nop/nmxd6/hp/pdf/msds_us.pdf

Nordic Ecolabelling, 17 March 2011. Nordic Ecolabelling for Furniture and Fitments [Online]. Available: http://www.nordic-ecolabel.org/Templates/Pages/CriteriaPages/CriteriaGetFile.aspx?fileID=2483

Philippine Statistics Authority, 26 January 2017. 2014 Annual Survey of Philippine Business and Industry (ASPBI) - Manufacturing Sector For Establishments with Total Employment of 20 and Over : Preliminary Results [Online]. Available: https://psa.gov.ph/content/2014-annual-survey-philippine-business-and-industry-aspbi-manufacturing-sector

Philippine Statistics Authority, 23 September 2016. 2013 Annual Survey of Philippine Business and Industry (ASPBI) - Manufacturing Sector : Final Results [Online]. Available: https://psa.gov.ph/content/2013-annual-survey-philippine-business-and-industry-aspbi-manufacturing-sector-final-results

Philippine Statistics Authority, 29 December 2014. 2012 Census of Philippine Business and Industry - Manufacturing Sector for All Establishments : Final Results [Online]. Available: https://psa.gov.ph/content/2012-census-philippine-business-and-industry-manufacturing-sector-all-establishments-final

Sasol, 10 March 2011. Material Safety Data Sheet Polypropylene [Online]. Available: https://www.columbus.co.za/files/downloads/MSDS_Packing_Materials.pdf

Shaw Polymers, 22 March 2017. Safety Data Sheet Polyethylene Polymer [Online]. Available: http://www.shawpolymers.com/wp-content/uploads/2017/04/SDS-Polyethylene.pdf

Shintech, Inc., 1 May 2015. Safety Data Sheet Polyvinyl Chloride Resin [Online]. Available: http://www.shintechinc.com/documents/5_1_15_PVC_SDS.pdf

Wikipedia, No Date. Monobloc (chair) [Online]. Available: https://en.wikipedia.org/wiki/Monobloc_(chair)

Wikipedia, No Date. Injection moulding [Online]. Available: https://en.wikipedia.org/wiki/Injection_moulding

Wikipedia, No Date. Polycarbonate [Online]. Available: https://en.wikipedia.org/wiki/Polycarbonate

Wikipedia, No Date. Thermosetting Polymer [Online]. Available: https://en.wikipedia.org/wiki/Thermosetting_polymer

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