

GREEN POLYURETHANE FOR ORNAMENTAL PRODUCTS

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Ornamental products are usually used to further enhance the beauty and value of a building. These ornamental products are made from cement, stone, wood, concrete or gypsum reinforced with glass fibres. Ornamental products produced with conventional raw materials may have some disadvantages and limitations (Table 1). In order to overcome these problems and to enhance the properties of the ornamental products, manufacturers have now begun to use polyurethane (PU) as the raw material. PU is the most versatile polymers and are always formulated for specific performances and processing requirements. The major application of PU is in the areas of flexible and rigid foams, but their significant applications are in coatings, adhesives, sealants and elastomers. Ornamental PU products offer more benefits than the traditional wood, gypsum and stone (Figure 1). Moreover, wide range of designs can be made and certain designs created with PU cannot be produced using wood due to the nature of the materials and the moulds used. However, most of the polyols that are used in PU industries originated from petrochemicals, which can be categorised into two classes: (a) hydroxyl-terminated polyethers and (b) hydroxyl-terminated polyesters. This technology on natural oil polyol, namely palm-based polyols is targeted for specific performance of PU for ornamental products.

THE GREEN TECHNOLOGY

With the recent push for environmental-friendly and sustainable products, there has been much interest in the development and utilisation of natural oil-based polyol. In this respect, MPOB invented the *Green Polyurethane for Ornamental Products* with incorporation of MPOB's patented palm-based polyols (Malaysian patent application No. PI 20055231 and US patent No. 76294778 B2).



Termite proof



Environmental-friendly



Light weight



Weather resistant

Figure 1. Advantages of polyurethane ornamental products.

PRODUCTION OF GREEN POLYURETHANE ORNAMENTAL PRODUCTS

Green PU ornamental products could be produced (Figure 2) with incorporation of certain percentages of palm-based polyols. MPOB is offering a number of formulations for the production of green PU ornamental products for various applications based on the designs and properties required.

THE PRODUCT

Green PU ornamental products from palm-based polyols exhibit better properties than PU ornamental products using petroleum-based polyols (Table 2).

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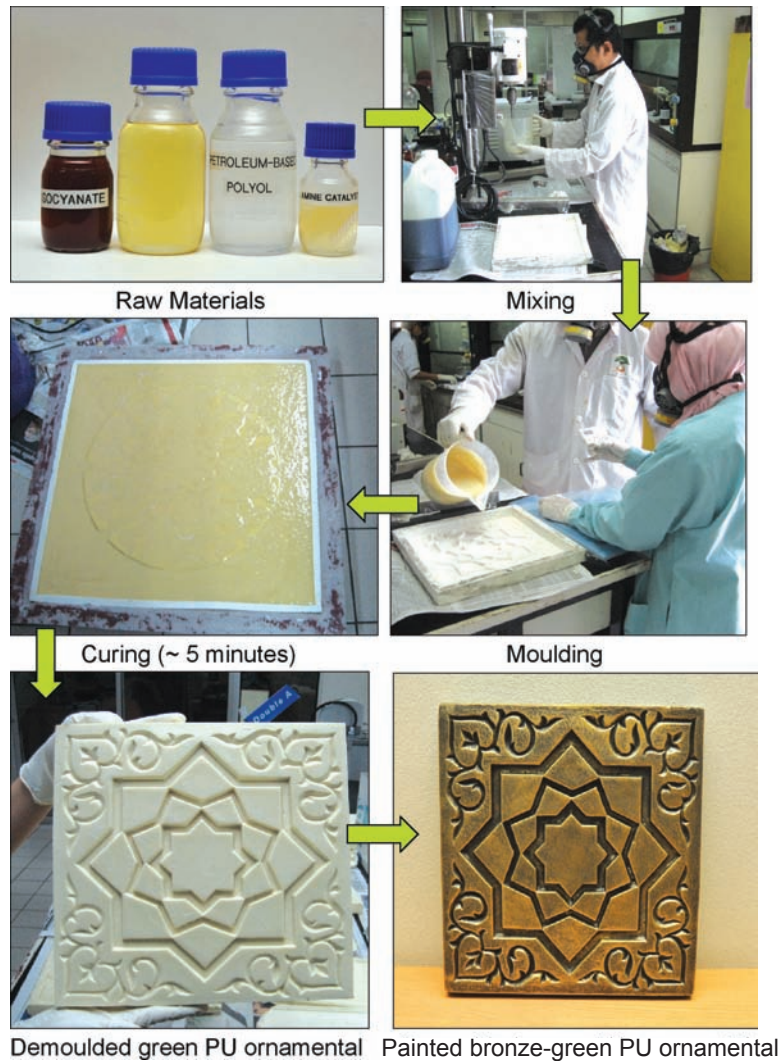


Figure 2. Production of green polyurethane ornamental product.

TABLE 1. ADVANTAGES OF PU-BASED ORNAMENTAL PRODUCTS AND LIMITATION OF CONVENTIONAL ORNAMENTAL PRODUCTS

Polyurethane	Conventional raw materials
Non-hazardous to health	With powder droplets occurrence
Maintenance free	Requires regular maintenance
Water resistance	Damage upon exposure to water
Sharp and flexible intricate design can be created	Profile not sharp
Algae proof	Attack by algae
Termite proof	Attack by termite
Environmental-friendly	Non-environmental friendly
Tough and durable	Crack over time
Low installation cost	High installation cost
Impervious to weather or humidity conditions	Non-resistant to weather
Light material	Heavy material

TABLE 2. COMPARISON BETWEEN PROPERTIES OF GREEN POLYURETHANE (PU) ORNAMENTAL AND PETROLEUM-BASED PU ORNAMENTAL PRODUCTS

Properties	Green PU ornamental (palm oil-based polyol)	Petroleum-based PU ornamental	Standard test
Density (moulded), kg m ⁻³	111-180	140-180	ASTM D 3574-03 Test A
Thermal conductivity, W m ⁻¹ K ⁻¹	0.05-0.0538	0.0538	Kemtherm QTM D3
Limited oxygen index (LOI), %	19-20	21	ASTM D 2863-00
Volatile organic compound (VOC), µg m ⁻³	Not detected at 60°C-90°C	Not detected at 60°C-90°C	MPOB method
Dimensional stability at 120°C, 5 hr	Stable	Stable	MPOB method
Compressive strength@ 10% deformation, kPa, N mm ⁻²	110-170	57.0	ISO 844-1978 (E)
Tensile strength, N mm ⁻²	1.3-1.5	0.82	BS EN 1607:1997
Bending stress, N mm ⁻²	1.53	1.49	BS EN 12089:1997
Bending strength, N mm ⁻²	2.6-3.4	1.87	BS EN 12089:1997
Water absorption-short term, kg m ⁻²	0.2	0.23	BS EN 1609:1997

POTENTIAL TAKERS

This technology could be adopted by PU ornamental product manufacturers and PU in-house formulators.

BENEFITS OF GREEN TECHNOLOGY

Green PU ornamental products can reduce use of fossil resources. Palm oil, a renewable resource, can be converted into polyols and formulated into several types of PU products besides ornamental

products. Green PU ornamental products are prepared using water as a blowing agent compared to hydrochlorofluorocarbons (HCFC) used conventionally, thus no impact on ozone layer depletion. The technology also promotes energy saving because green PU products have good insulation property.

ECONOMIC ANALYSIS

Return on investments (ROI): 25%
Payback period: 3 years

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