PALM-BASED MOULD OIL FOR THE STEEL/ CONCRETE INDUSTRY

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In concrete block production, a mould release agent is needed for lubrication during the process of detaching the moulded concrete from the mould. The mould release agent is called mould oil. Currently, concrete block manufacturers use a petroleum-based mould oil as the mould release agent. Frequent use of this oil causes health problems and has a negative environmental impact in the workplaces. Due to its toxicity, flammability (strong petrol odour) and ever-increasing price of the present commercial mould oil, the search for an alternative has been actively carried out. A new formulation of mould oil derived from palm olein has been discovered (*Figure 1*). It has optimum performance fulfilling every aspect of the specifications for a greener mould oil for concrete production besides ensuring that the production process and the finished concrete units conform to higher standards and more stringent conditions and regulations.

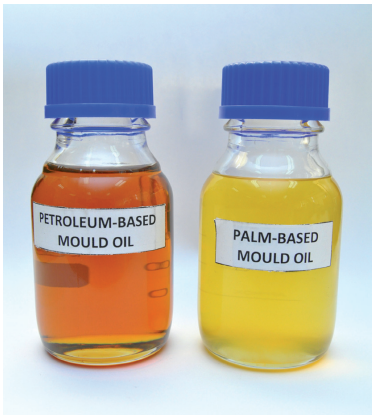

Figure 1. Palm-based mould oil in comparison to petroleum-based mould oil.

BLENDING FACILITY

A mixer tank (*Figures 2* and *3*) with a blending capacity of up to 200 litres of mould oil is used to produce the palm-based mould oil using the optimum formulation recipe. The mixer tank requires 0.4 kW/415 V for the smooth operation of an agitator motor and a heater. It is mobile and therefore this can facilitate the relocation of the tank on the factory production floor.

Figure 2. A 200-litre capacity mixer tank for blending of palm-based mould oil.

Figure 3. Agitation and heating system of the mixer tank.

PERFORMANCE TEST

Performance of the mould oil is indicated by the condition of the moulded concrete after being detached from its mould. Large-scale field trials conducted at a concrete production site showed very promising results. The finished concrete blocks showed no oil stain on the surface (*Figure 4*) and no breakage (broken edges or broken corners) during cake demoulding; in fact, the moulded concrete blocks and the moulds showed smooth surfaces without cement sticking onto the sides and bottom.

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(a)

(b)

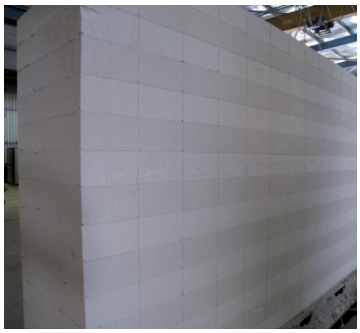

Figure 4. Comparison of mould oil performance on finished concrete blocks.
(a) Mould oil stain (visibly darker concrete blocks); (b) clean surface.

ANALYSIS

The lubricating characteristics of the palm-based mould oil were measured according to the respective ASTM test methods (*Table 1*). The test on kinematic viscosity showed that the formulated palm-based mould oil retained its appropriate viscosity requirement for good performance whereas the corrosion test indicated non-corrosive material in the formulation, while the Rancimat test proved that the formulation had high stability in the presence of oxidation.

TABLE 1. LUBRICATING PROPERTIES OF THE PALM-BASED MOULD OIL

Property	Method	Result
Kinematic viscosity @ 40°C (cSt)	ASTM D445	58.42
Kinematic viscosity @ 100°C (cSt)	ASTM D445	11.29
Copper strip corrosion	ASTM D130	Classification 1a
Oxidative stability (hr)	EN 14112	22.83

ECONOMIC ANALYSIS

- Annual consumption of mould oil in a typical factory with a capacity of 17 000 m^3 yr^{-1} concrete production is 60 000 litres.
- The current price of the petroleum-based mould oil is around RM 6 $litre^{-1}$.
- The estimated procurement cost of the petroleum-based mould oil is RM 360 000 annually.
- The price of the palm-based mould oil is estimated around RM 4 $litre^{-1}$ (based on the price of RM 2800 t^{-1} of palm olein).
- The estimated procurement cost of the palm-based mould oil is RM 240 000, implying a saving of around 33% in procurement cost.

TRANSFER OF TECHNOLOGY

- Formulation fee: RM 50 000.
- Royalty: 5% of annual profits.
- Consultation fee: negotiable, if required.

ADVANTAGES/BENEFITS

- Enhances the green image of the concrete industry.
- Significant reductions in mould oil procurement and production costs are anticipated if the production lines for mould oil and concrete blocks can be integrated.
- Less hazard, hassle and maintenance in the workplace – no irritating odour, no flammable gas and cleaner moulds.
- Meets Hazard Analysis and Critical Control Points (HACCP) system requirement as food-grade lubricant is used.

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