OIL PALM PHENOLICS AS A SOURCE OF SHIKIMIC ACID - AN MPOB-MIT COLLABORATION

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The global palm oil industry generates about 85 million tonnes of vegetation liquor annually which are discarded as palm oil mill effluent (POME). Malaysia alone produces about 45 million tonnes of POME. Discharge of the untreated waste from any edible oil process, including for palm oil, is highly polluting and this continues to be of global environmental concern. Although Malaysia has enforced stringent regulatory environmental standards, the challenge of converting such agricultural waste to high value products has remained elusive. MPOB has discovered that oil palm vegetation liquor is a very rich source of phenolics, and has developed a novel process for extracting these oil palm phenolics (OPP). This discovery provides an exceptional opportunity to transform a bio-burden into products with a range of potential applications having implications for health and wellness. The novel process (Sambanthamurthi *et al.*, 1998; 2008) developed by MPOB provides an opportunity and a financial incentive to reduce pollution from POME while enhancing the income of the oil palm industry.

More recently, in collaboration with the Massachusetts Institute of Technology (MIT), MPOB discovered that the main constituent of OPP is caffeoylshikimic acid which can be hydrolyzed to shikimic acid, a very valuable product. OPP contain numerous phenolics (Sambanthamurthi *et al.*, 2009), including caffeic acid, protocatechuic acid, p-hydroxybenzoic acid and three isomers of caffeoylshikimic acid. The three isomers of caffeoylshikimic acid serve as signature compounds, and are present at 10 800 ± 2400 ppm in OPP. Caffeoylshikimic acid can be hydrolyzed to caffeic and shikimic acids under appropriate conditions. In addition, OPP contain about 1% endogenous shikimic acid.

SHIKIMIC ACID

Shimikic acid, found naturally in various plants, plays a significant role as a biochemical intermediate compound in plants and also microorganisms. It is known to be an important precursor for the synthesis of aromatic amino acids, phenolics and alkaloids, amongst many others. One of the most pertinent advancements in relation to the exploitation of shikimic acid in the pharmaceutical industry is the production of *Tamiflu*, a type of drug used against avian flu in recent years. A short supply of shikimic acid is the major bottle-neck in the production of *Tamiflu*

The demand for shikimic acid is expected to increase dramatically with the growth in world population and the concurrent growing need for it in various industrial and pharmaceutical uses. At present, the world demand for shimikic acid is met from the fruit of the Chinese star anise; however, it is generally found in substantially lower concentrations from this source, for example, compared to OPP. Accordingly, it would be desirable to explore other sources of shikimic acid so as to aid in fulfilling the global demand.

SHIKIMIC ACID FROM OIL PALM PHENOLICS (OPP)

Caffeoylshikimic acid is the major phenolic acid of OPP accounting for more than 1% of the total solids. Caffeoylshikimic acid can be hydrolyzed to caffeic and shikimic acids under appropriate conditions. It also contains 1% endogenous shikimic acid.

BENEFITS

The innovation has important health, environmental and economic implications. The global

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shortage of shikimic acid sources makes this innovation especially significant. The abundance of palm oil mill waste guarantees a reliable and constant source of supply. This discovery is also a boost to the palm oil industry, currently facing a highly competitive edible oil market

SHIKIMIC ACID – ECONOMICS

- The current market size for *Tamiflu* is estimated at 400 million doses per year.
- One dose of *Tamiflu* requires 130 mg shikimic acid for synthesis.
- Requirement of shikimic acid: 400 x 10^6 doses at 130 mg per dose = 52 000 kg = 52 t shikimic acid.
- The price of shikimic acid from China has soared from USD 40 to USD 1000 a kilogram.

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