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**FISH OIL: REFINING, STABILITY AND
ITS USE IN CANNED FISH FOR
THE INDONESIAN MARKET**

**A thesis presented in partial fulfilment of
the requirements for the degree of
Doctor of Philosophy
in Food Process and Product Development at
Massey University,
New Zealand**

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1992

Food Process - Food Dept.

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ABSTRACT

Fish oil has been proved to have health benefits for humans, but the utilization of fish oil for human consumption is very limited.

A survey of 19 Indonesian fish oil producers showed that fish oil was produced from fish meal processing and fish canning. Most Indonesian fish oils, especially fish meal oil, were chemically, physically and organoleptically unacceptable. But, as they contain high levels of omega-3 fatty acids, a refining process was required to improve the quality making the oil acceptable for human consumption.

The resin refining process, a no heat process, was used to refine the crude oil. Fish oil-resin volume ratio affected the refined fish oil quality and ratio 1:1 was recommended. The refined oil quality could be further improved by multiple refinings, and this method was successfully applied to Indonesian fish meal oil having a strong undesirable odour. The refining rate could be accelerated by application of vacuum pressure to the column. The height of the column showed a significant effect on the refined fish oil quality, but the column diameter had no effect. Resin refining reduced the quantity of natural antioxidants and changed the proportion of volatile flavour compounds. Most Indonesian fish oil producers intend to adopt the resin refining process.

Storage tests indicated that the refined oil deteriorated faster than unrefined oil. This trend was shown by both Indonesian and New Zealand oils. Ter-butylhydroquinone (TBHQ) proved as the most effective antioxidant for fish oil, but this antioxidant is not listed as a permitted antioxidants for use in Indonesian foods. Butylated hydroxyanisole (BHA), as the best alternative, is recommended. 0.01% BHA was sufficient to recover the loss of natural antioxidant during resin refining. Vacuum package was very effective in reducing the deterioration rate due to autoxidation.

Canned fish was used as a mean of delivering fish oil to Indonesian consumer. The proposed product type was generated through supermarket, consumer and canned fish processor surveys. The survey results suggested that the fish oil to be disguised in a canned fish product using sardine as raw material, tomato sauce as medium and 155g tall tube-can as the container.

The most acceptable tomato sauce formula developed using mixture design is 18.6% tomato paste, 28.0% fish oil, 46.6% water, 3.7% salt and 3.1% sugar. The canned fish should be sterilized using

vacuum head space-can at 121.1°C to obtain optimum protection of omega-3 fatty acids.

The experiment using the Plackett and Burman design showed that the canned fish product should involve pre-cooking, vacuum head space, garlic, shallots and vinegar additions. Sterilization time needed to be optimized. The optimization experiment indicated that 50 minutes was recommended to sterilize the canned fish with disguised fish oil. Sterility and incubation tests showed that sterilization at 121.1°C for 50 minutes was sufficient to produce safe product.

Consumer testing in five cities of Indonesia showed that only a minority of consumers did not like the developed product. Most of the consumers intend to buy the product, if the product is released to the market. A survey of medical doctors supported the proposed product, as over 90% of them were willing to suggest patients consume the product for nutritional purposes.

And if all the trees on earth were pens and the ocean (were ink), with seven oceans behind it to add to its (supply), yet would not the words of Allah be exhausted (in the writing): for Allah is Exalted in power, full of Wisdom.

(The Holly Qur'an 31: 27)

To my wife, Giyatmi, and my daughter,
Husna Izzahnisa Omegita

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