GENERAL CONCLUSION
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Vegetable oil refinery industries are producing a number of byproducts depending on the fats and oils processed and the methodologies adopted for their processing. These byproducts play a major role in the economy of the refinery industries. The byproducts like acid oil, fatty acid distillate, gums, and waxes are subjected to further processing so as to produce various value added products. Biotechnology using lipase catalyzed reactions along with molecular distillation process can be considered for development.

Lipase catalyzed reactions like hydrolysis and esterification are quite promising in making medium chain fatty acids, medium chain glycerides and monolaurin from coconut acid oil. The technological information emerging from the present study is expected to be commercially useful in processing coconut acid oil.

Most of the fats and oils are now processed by physical refining process to reduce oil loss and produce refined oils rich in micronutrients like sterols, tocopherols, squalene etc. This process produces fatty acid distillate as major refinery byproduct. Lot of interest is growing to utilise this kind of refinery byproducts. Coconut, palm kernel and rice bran fatty acid distillates are thus very important byproducts in producing medium chain fatty acids and derived glycerides. The coconut and palm kernel fatty acid distillates can be used by using lipase-catalyzed reactions
followed by molecular distillation. The combined microbial lipase and molecular distillation appear to compete with the chemical methodologies for the purpose of making medium chain glycerides.

The present study has investigated the recovery of squalene from RBO fatty acid distillate and sterol and tocopherol from soybean oil deodorizer distillate. In each case a combined approach of biohydrolysis, bioesterification and molecular distillation provide the suitable technology route of recovering squalene in high amount from RBO FAD and sterol and tocopherol from SBO DD. The lipase-catalyzed processes should receive more importance in processing such byproducts, as mild reaction conditions can protect these components from aerial oxidation.

The importance of various specialty fat products is increasing due to their specific application in controlling obesity and cardiovascular disorders. In recent times the major focus is on glycerides rich in plant sterols and diacylglycerol. In the present study, the lipase-catalyzed reactions along with molecular distillation have been successfully utilized to produce glycerides rich in plant sterols from soybean oil deodorizer distillate and diacylglycerol both from RBO FAD and soybean oil DD. These valuable products of new kind should be attractive in the market as specialty products using green technology.

Structured glycerides containing medium chain and/or higher unsaturated glycerides are also produced from fatty acid distillates by
adopting biohydrolysis, bioesterification, bioalcoholysis reactions along with molecular distillation technique. The cost of molecular distillation process can be compensated by the higher value of the structured glycerides and also by low price of the starting raw materials like fatty acid distillate.

Lyso-phospholipids, an important material for food and pharmaceutical industries, are also produced very efficiently by utilizing bioalcoholysis reaction followed by acetone fractionation process from RBO and soy phospholipid. Again the lipase catalyzed reactions using specific lipases are unique in this kind of product development.

Rice bran wax, an important byproduct which is mostly sold at very cheap price, can be processed to produce light coloured de-oiled wax of high industrial value. The concept of utilizing microwave heating to hydrolyze rice bran wax is an important development. More sustained study would be appreciated to optimize the process in order that it may find importance in industry particularly in making policosanol concentrate.

Overall investigations have generated a number of technical information pertaining to process developments and product developments. These developments may be commercially important to the fats and oils refinery industries in making valuable products from the refinery products studied in the present investigations.