

The First of Its Kind of Industrial Application of Supercritical Fluid on Continuous Chromatography by Simulated Moving Bed

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1. Introduction

Eicosapentaenoic acid (EPA) is a key anti-inflammatory long-chain polyunsaturated omega-3 fatty acid in fish oil. The evidence for unique effects of EPA on reducing the levels of triglycerides and atherogenic lipoproteins is growing.

2. Materials and Methods

In Taiwan, the separation of ethyl ester of Eicosapentaenoic acid from esterified fish oil was conducted on industrial scale simulated moving bed (SMB) with supercritical fluid of carbon dioxide and ethanol as the desorbent and 2-EP as the adsorbent. A six-column SF-SMB with 200 mm in diameter designed by JOPE Co. (Kaohsiung, Taiwan) was employed and divided into three sections with 2/2/2 configuration. In this SF-SMB, the recycling of carbon dioxide is conducted by depressurization and condensation. The supercritical state for the chromatography was controlled at 130 bar and 45 °C with ethanol as the co-solvent.

3. Results and discussion

With an annual capacity around 8.4 tons, the SF-SMB produces EPA with 90.0% of purity and 94.0% of recovery. The EPA is further separated by a second operation of SMB with liquid methanol as mobile phase and the purity and recovery of EPA in the final product could be as high as 97.2% and 95.0%, respectively.

4. Conclusions

The use of carbon dioxide and ethanol as co-solvent in SF-SMB offers many advantages including environmentally friendly, cost-effective as well as low solvent consumption. More applications of supercritical fluid to the continuous chromatography are undergoing, and this will further extend the use of supercritical fluid in industries.



Figure 1. The appearance of industrial scale SF-SMB