

SUPERCRITICAL FLUID EXTRACTION OF RESIDUAL STYRENE MONOMER IN POLYSTYRENE GRANULES

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Polystyrene is a thermoplastic with a lot of desirable properties as transparent, easily coloured and easy to manufacture. For these reasons, it is one of the most useful plastic used in different common consumption products as cups, food containers, bags, toys, home furniture, building materials, etc. The main problem with this plastic is the residual styrene which can migrate from the product and therefore be in contact with the user. The acute toxicity of styrene has been well studied, being a skin and mucous membranes irritant and having narcotic properties. This makes necessary the development of a fast, efficient and reproducible method for the determination of this compound.

The extraction of styrene monomer from polystyrene was studied by using supercritical fluid extraction. Other alternative methods as Soxhlet extraction, assisted microwave extraction or head-space emission were evaluated and compared with the previous one.

For SFE, 0.5 g of sample were introduced into the extraction vessel and CO₂ was used as the supercritical fluid. The extracted styrene was trapped by a coaxially heated capillary restrictor immersed in a graduate dark vial with 10 ml of methylene chloride.

Analysis of extracts were performed by gas chromatography with mass spectrometry detection. A SPB-5 capillary column (30 m x 0.32 mm, 0.5 µm I.D.) was used, and 2 µl of sample were injected in the splitless mode. The column temperature program was from 35 °C (10 min) to 150 °C at a rate of 7 °C/min to 220 °C (6 min) at a rate of 20 °C/min. Injector temperature was 300 °C and detector temperature was 250°C. The detection mode was SIM (selected ion monitoring) focused on 104 and 78 ions.

SFE better extraction performance was accomplish at 7000 psi, 105 °C, 30 min dynamic time, 2 min static time and 105 °C restrictor temperature. Higher extraction pressures gave worse results, probably due to styrene volatility. Finally, grinding the sample greatly improved the extraction efficiency. These results gave better extraction efficiency when compared with the other extraction methods tested.

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