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Solvent Free Microwave Extraction of Essential Oils: A Clean Chemical Processing in the Teaching and Research Laboratory

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Abstract : Microwave Clevenger or microwave accelerated distillation (MAD) is a combination of microwave heating and distillation, performed at atmospheric pressure without added any solvent or water. Isolation and concentration of volatile compounds are performed by a single stage. MAD extraction of orange essential oil was studied using fresh orange peel from Valencia late cultivar oranges as the raw material. MAD has been compared with a conventional technique, which used a Clevenger apparatus with hydro-distillation (HD). MAD and HD were compared in term of extraction time, yields, chemical composition and quality of the essential oil, efficiency and costs of the process. Extraction of essential oils from orange peels with MAD was better in terms of energy saving, extraction time (30 min versus 3 h), oxygenated fraction (11.7% versus 7.9%), product yield (0.42% versus 0.39%) and product quality. Orange peels treated by MAD and HD were observed by scanning electronic microscopy (SEM). Micrographs provide evidence of more rapid opening of essential oil glands treated by MAD, in contrast to conventional hydro-distillation.

Keywords : clevenger, microwave, extraction; hydro-distillation, essential oil, orange peel
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