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Investigation of influential parameter in the supercritical fluid extraction of turmeric root: a screening design study

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At present, Supercritical fluid extraction with CO_2 is gaining attention due to production of solvent free extract. In this technique, extraction is carried out in supercritical region where fluid possesses the properties of liquid and gas both. There are numerous operating parameters reported in literature affecting the extraction process. Amongst them, five parameters are considered as most important parameters such as pressure, temperature, solvent flow rate, particle size and addition of co-solvent. These parameters need to optimize for the maximum extraction of solute form solid matrix. For this, widely employed optimization technique i.e. design of experiment is used through various software such as Design expert, Minitab and Quantum XL etc. Design of experiment technique provides a list of experimental runs considering different combination of operating parameters. Number of experimental runs is directly proportional to the number of operating parameters considered. To reduce the number of experimental runs, operating parameters first need to be screened based on their contribution to maximize the extraction yield. Design expert is providing a new feature name screening design to avoid more number of experimental runs. In present work, turmeric root is considered as raw material where screening design is applied. It gives 10 experimental runs to perform considering five operating parameters, which are varied as 200-400 bar, 40-60°C, 5-15 g/min, 0.-0.73 mm and 0-15% of solvent flow rate. Experimental extract content is inserted in the response section and results are analyzed using Design expert 11. Pressure is found to be least influential parameter among all five parameters as its contribution is 0.1% only towards the maximum extract. % contribution for temperature, flow rate, particle size and co-solvent are as 63.51, 13.44, 3.07 and 12.29%, which indicates that temperature is the most important parameter in the extraction of turmeric root. Main effect model is fitted with the experimental data which shows well agreement as R2 value is close to unity. Therefore, it can be concluded that pressure can be fixed at a constant value while varying other parameters for the optimization. Screening design is emerged as a very useful technique to save the time and money also.

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