VALIDATION OF A PSEUDO-CONTINUOUS PROCESS FOR OBTAINING FOOD INGREDIENTS FROM PLANT MATERIALS WITH CO_2 RECYCLING BY THE AID OF SUPERCRITICAL ADSORPTION WITH OAT BRAN

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An efficient process for extracting food ingredients from plant materials should demand the use of reduced volume of extracting solvent to obtain a final product that is free of solvent and invest reduced processing times and costs. To achieve this efficiency, in this study it was incorporated a carbon dioxide tank of 15L and two adsorption columns of 0.65L and 0.4L to a commercial pilot unit of Supercritical Fluid Extraction (SFE) with 2 extractors of 5L. Annatto seeds and oat bran were used as model plant material and model adsorption material, respectively, to validate this process. The CO_2 that is inside of the CO_2 tank enters the SFE unit at 200gCO_2/min, where it acquires the conditions of processing at 40°C and 200bar after a static extract time of 20 min. The CO_2 is then purified when it gets in contact with the oat bran within the adsorption column of 0.65L returning towards the CO_2 tank. At the end of 70min (dynamic extraction time) of supercritical CO_2 extraction, the extractor of 5L is depressurized and CO_2 passes through the second adsorption column of 0.4L where the oat bran adsorbs the remaining extract. At the same time starts a new cycle of extraction with another column of 5L with fresh annatto seeds. The process was successfully performed in pseudo-continuous mode with 4 extraction cycles of 70min each and two replicas. The proposed novel process reached 63% extraction efficiency, in that only 25% of 300g of the adsorbent material placed inside column of 0.65L was needed to purify the CO_2 during the recycling. Processing 3,500g of annatto seeds per extraction cycle without and with CO_2 tank requires 14,000.00 and 2,368.02 ± 91.96gCO_2, respectively. Consequently, the pseudo-continuous extraction at pilot scale generated an saving equivalent to 83% for solvent consumption. Acknowledgements: Ricardo A. C. Torres thanks Capes for their doctorate assistantship. Diego T. Santos thanks CNPq (processes 401109/2017-8; 150745/2017-6) for the post-doctoral fellowship. M. Angela A. Meireles thanks CNPq for the productivity grant (302423/2015-0). The authors acknowledge the financial support from FAPESP (process 2015/13299-0).