High intensity ultrasound assisted extraction of quercetin from yellow onion peel

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Onion is one of the most widespread vegetables in the world. Its annual production reaches 93 million tons, which 15% are considered waste rich in phenolic compounds, especially quercetin. Among the alternative extraction technologies, high intensity ultrasound assisted extraction (UAE) stands out, being a great alternative for extracting sensitive compounds. Thus, the objective of this work was to optimize UAE parameters to obtain bioactive compounds from onion peels. The extracts were obtained in an ultrasonic probe at 19 kHz for 6 minutes using an ice bath (0 °C) or a thermostatic bath (20 °C). The variables evaluated were ultrasound power (450 W – 150 W), sample/solvent ratio (1:45 – 1:65 g/mL) and type of solvent (99.5% ethanol – 60% ethanol v/v). The extracts were evaluated for overall yield, phenolic compounds, flavonoid content, antioxidant activity and important flavonoids were quantified by HPLC. A kinetic study was performed at optimized conditions. The best condition was compared with maceration, a conventional process. The most suitable condition for obtaining phenolic compounds was 450 W, 60 % ethanol and a solid/liquid ratio of 1:65. However, for the extraction of quercetin, 80 % ethanol was the best solvent, with a difference of approximately 21 % in relation to the maceration. Two main peaks were identified, referring to free quercetin (6.44 mg/g of onion skin) and to quercetin in the glycolyzed form (7.27 mg/g of onion skin). The extraction time was optimized in 5 minutes, indicating that the technique used is significantly faster and more effective than other commonly used. However, after this time, the yield of compounds started to decrease indicating some degradation induced by the process. Extraction performed at 20 °C contributed to increase the overall yield of bioactive compounds, especially quercetin. However, the use of the ice bath was responsible for maintaining the antioxidant activity at higher levels. Despite the higher bioactive yield, the lower antioxidant activities indicate the degradation of secondary at higher temperatures, such as phenolic acids and vitamins. Therefore, UEA proved to be an excellent sustainable technique for extract sensitive compounds with less time and energy demand.