An orange by-product flour as a stabiliser of oil-in-water emulsions

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This research aimed to evaluate the use of an orange by-product flour (OBF), rich in pectins (22 g/100 g dry matter (dm)) and with high antioxidant activity (28 mg TROLOX equivalent/g dm) in the formulation of oil-in-water emulsions (6 % oil w/w). The OBF was obtained after extracting the orange juice and blanching, freeze-drying, and milling (<0.5mm) the remained pulp and peel. Different concentrations of OBF in the emulsions were evaluated (1.0, 2.4, and 3.4 % w/w named 1.0OBF, 2.4OBF, and 3.4OBF, respectively) by comparing them with a control emulsion prepared with a synthetic emulsifier (Tween®20) (0.21 % w/w). The emulsions were assessed in terms of apparent viscosity (rotational viscometry), Z potential (electrophoretic mobility), droplet size distribution and flocculation after their preparation and 24 h later (optical microscopy and image analysis), and creaming after 24 h. ANOVA and Tukey tests were applied to evaluate differences ($p<0.05$) among the emulsions. The addition of OBF significantly ($p<0.05$) increased the viscosity of the emulsion compared with the control (152±6 mPa·s) only for 3.4OBF (211±1 mPa·s). Similarly, the Z potential absolute value was only significantly higher than the control (-15.8±0.9 mV) for 3.4OBF (-19.7±1.3 mV). The control showed the smallest droplet (median diameter 2.4±0.1 µm) and 1.0OBF and 2.4OBF the largest (10.8±0.4 µm), increasing the OBF concentration up to 3.4 % resulting in a 30 % decrease of the droplet size comparing with 1.0OBF (7.7±0.1 µm). The control was highly flocculated (41 %) while emulsions containing OBF showed no flocculation. No differences ($p>0.05$) in the median diameter after 24 h was observed in control and 3.4OBF, while 1.0OBF and 2.4OBF showed 75 and 16 % median diameter increases, respectively. No creaming was observed in 3.4OBF while control, 1.0OBF, and 2.4OBF showed high values of creaming index (63, 77, and 50 %, respectively). Overall, the use of the OBF allowed to obtain a more stable emulsion than the one formulated with a synthetic emulsifier depending on the concentration of the material, being more stable the emulsion prepared with 3.4 % OBF, and also provided antioxidant capacity which might protect the oil from oxidation.