Energy balance during twin screw extrusion cooking of maize starch

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An experimental device has been implemented on a twin screw extruder CLEXTRAL BC 45 to measure the mechanical and thermal energy inputs to the product, coming from the motor and the heating system respectively, as well as the energy loss by the cooling system; convection and radiation losses at the external surface of the barrel have been estimated by surface temperature measurements. The energetical consumption associated to the product has been deduced from these measurements obtained for steady working state of the machine. Experimental trials have been carried out with feed rate and screw speed changes. Starch modifications have been quantified by differential scanning calorimetry, measurements of intrinsic viscosity, water solubility index. When screw filling rate increased (from 10 to 25%), the specific energetical consumption of the product decreased (from 160 to 100 Kwh/t). The various product transformation indexes show that the transformation level increased with the specific energetical consumption: for instance, the intrinsic viscosity of the extruded product decreased (from 190 to 100 ml/g) as the specific energetical consumption increased (from 100 to 250 Kwh/t). In conclusion, this procedure gives an evaluation of the processing intensity, enabling optimization.

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