

A pregelatinized resistant starch type 5 produced by thermoplastic extrusion.

Lucas K. T. Hori*, Marcio Schmiele, Yoon K. Chang.

Abstract

Resistant starch is a portion of the starch which is not hydrolyzed by the enzymes in the digestive tract, acting as a dietary fiber, being a healthier alternative to be used in foods containing starches. The aim of this work was to produce pregelatinized resistant starch type 5 by thermoplastic extrusion, an alternative form does not generate waste and not request the use of enzymes, reducing costs. There was possible to obtain 17% of resistant starch type 5.

Key words:

Corn starch, fatty acid, amylose.

Introduction

Starch is the major source of energy for human diet and present different digestible rates. One fraction of starch, called resistant starch, is not hydrolyzed by amylolytic enzymes in the gastrointestinal tract, and this kind of starch is considered as a dietary fiber¹.

Furthermore, the resistant starch is fermented by the intestinal microflora in the colon, releasing short chain fatty acids, promoting benefits for health². Five types or resistant starches are known, and the type 5 (RS5) is obtained by amylose-lipids complex, usually produced by debranching the amylopectin with isoamylase or pullulanase, following the complexation with fatty acids³. The aim of this work was to produce RS5 by thermoplastic extrusion in a single screw extruder using corn starch and a central composite design with three independent variables: feed moisture ($x_1 = 15\text{-}23\%$), palmitic acid ($x_2 = 0\text{-}5\%$) and stearic acid ($x_3 = 0\text{-}5\%$).

Results and Discussion

The trials were analyzed in relation to RS5, digestible starch, water absorption and solubility indexes, expansion index, instrumental color and pasting properties. The data were evaluated by surface response methodology in order to obtain the optimal point, aiming the highest RS5 level (Fig. 1).

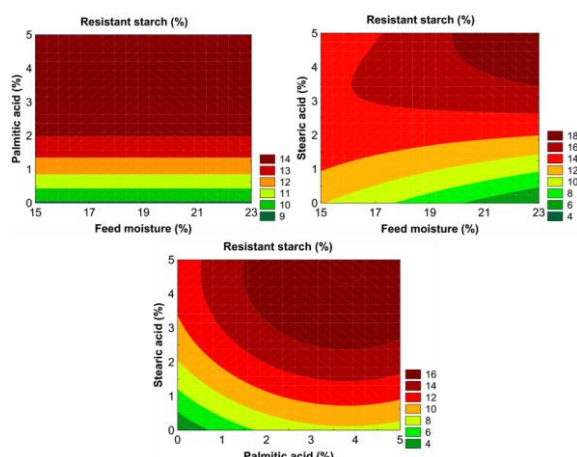


Figure 1 – Contour plots for resistant starch type 5 levels.

The increasing in b^* values was observed due the complexation of the fatty acids inner the single-helical chains of the dextrinized starch. Besides that, the decrease in breakdown occurred due the restriction of amylose leaching and the delay in swelling of the intact starch granules. The optimal point was obtained by the

use of 20.26% feed moisture, 3,62% of palmitic acid and 4.79% stearic acid, obtaining a desirability 1.00.

The results of the optimal point were: $17.17 \pm 0.21\%$, $81.38 \pm 0.21\%$, 10.06 ± 0.51 and $13.11 \pm 1.01 \text{cP}$ for RS5, digestible starch, b^* and breakdown, respectively. The predict values of the mathematical models were 16.17%, 82.61%, 10.23 and 12.00cP for RS5, digestible starch, b^* and breakdown, respectively. Therefore, the mathematical models were validated, since the relative variations were lower than $|10\%|$, with values of 5.28% (RS5), -1.51% (digestible starch), -1,69% (b^*) and 8.47% (breakdown). The enthalpy required for the native starch gelatinization ($15.55 \pm 0.84 \text{J.g}^{-1}$) and for the optimal point ($5.86 \pm 0.60 \text{J.g}^{-1}$) indicates a degree of gelatinization of $62.32 \pm 1.03\%$ (Fig. 2).

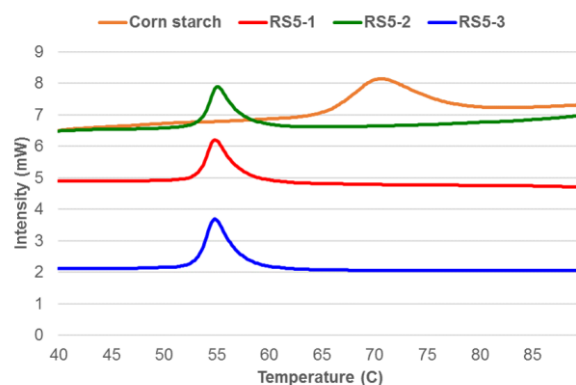


Figure 2. Differential scanning calorimetry (DSC) of the native starch and the RS5.

Conclusions

The extrusion process allowed the production of RS5. Stearic acid showed a better performance as palmitic acid, allowing the production of 17.17% of pre-gelatinized RS5, with a high aggregate value because it is a pregelatinized starch.

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