Baking temperature and prefermentation effects on double-layered flat bread delamination phenomenon: is it possible to lower the baking temperature for an energy-saving perspective ?

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Double-layered flat bread is widespread in Middle Eastern and North African countries and is becoming increasingly popular in Western countries. Its oven rise with delamination during baking is a prime quality criterion for consumers. Baking is a process that involves mass, heat and momentum transfer, with high levels of coupling between them.
Special ovens at high temperatures (350 to 550°C) are needed to produce the specific structure with two layers separated by a gas pocket in-between.
The simplest baking methods of flat breads have remained almost unchanged since ancient times, which raises concerns today in terms of excessive energy consumption. Optimum baking temperatures are also not always used in commercial practice. The aim of the present study is to better understanding of the impact of heat transfer and yeast generation of carbon dioxide on the flat bread delamination phenomenon kinetic.

Different baking temperatures (300 °C, 200, 220 180 and 160°C) and fermentation times were tested. In order to follow the expansion of gas pockets, a new approache of visual appreciation was proposed (with 5 levels of delamination quality). Specific volume was measured in complement. And for a more thorough quality evaluation, the mass loss during baking, and color were also measured. In unyeasted dough, the frequency of full delamination (level 5) was clearly maximized at the highest baking temperature and level 5 was gradually replaced by lower quality levels, as the baking temperature was decreased. We assumed that as baking temperature is decreased, the evaporation becomes limited to favor the rupture of gas cell walls over a large section of the flat bread. Based on these quality levels, a conceptual scheme was proposed for the delamination process. Another part of the work consisted in the evaluation of fermentation as a step to counterbalance low baking temperatures. Results showed that it only partially counterbalanced the decrease in the baking temperature. The presentation will be concluded with some alternatives for future investigation, like partial vacuum baking, with numerical simulations as demonstration support.