

## COMMUNICATION TO THE EDITOR

## The Bread-Improving Effect of Heptane and Hexane

DEAR SIR:

Solvents have been employed for many years in experiments relating to the chemistry of flour and dough, but little work appears to have been done to establish the effects of solvents *per se* in dough. Several (e.g. 1,2) investigators have studied, to some extent, the effects of flour extraction by several different "fat solvents" on gluten quality and baking properties. No one, as far as we are aware, has studied the consequence of adding solvents directly to dough.

In work related to flour lipids, we wished to define more precisely the baking role that residual solvent contained in certain lipid fractions might be playing. During the subsequent investigation, we discovered that small amounts of certain organic solvents exerted profound improving effects on dough. These materials were heptane and hexane, and, to a lesser degree, other hydrocarbon solvents. A typical example of the improving action is illustrated in Fig. 1.

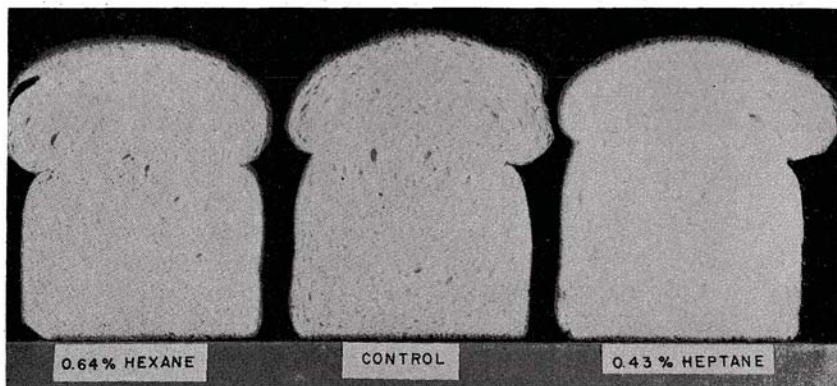


Fig. 1. Effect of 0.64% hexane and 0.43% heptane, flour basis, on bread crumb structure.

The breads shown in this photograph were made by a conventional laboratory sponge-dough procedure. The loaves made with 0.65% hexane and particularly 0.43% heptane (both on flour basis), added to the dough, had a much finer grain, more uniform crumb structure, and brighter color than the control. These results are typical of those obtained with a rather wide variety of bread flours over many months of experimentation.

The amounts of heptane and hexane cited above appeared to be optimum for use in our laboratory baking procedure, but only a portion of this amount was probably involved in the dough-improving mechanism. An appreciable portion of the solvent added was undoubtedly lost by volatilization during mixing in the open McDuffee bowls. We have found that pilot-sized doughs mixed in an enclosed horizontal-type mixer require roughly half the above amounts of solvents for optimum results.

For heptane or hexane to exert a dough-improving effect, it is essential that added fat be present in the dough. Table I shows the

TABLE I  
RELATION OF HEPTANE AND ADDED LARD TO BAKING QUALITY<sup>a</sup>  
(Averages of duplicate bakes — two doughs, four loaves)

HEPTANE	GRAIN SCORE	LOAF VOLUME	PROOF TIME
%		cc.	min.
No lard			
0	7.6	2709	59.8
0.22	8.0	2734	61.0
0.43	7.3	2639	90.5
0.65	..	very small	>106
3% lard			
0	7.6	2786	61.3
0.22	8.3	2767	58.3
0.43	9.5	2717	59.0
0.65	9.6	2652	58.3

<sup>a</sup> Percent solvent based on flour by weight.

results of adding various amounts of heptane to dough, both with and without added lard.

Without added dough lard, increased heptane generally led to poorer grain scores, lower loaf volumes, and prolonged proof times (loaves were proofed to height). When 0.65% heptane was employed in the dough, the ability of the loaves to proof was completely inhibited.

With added lard in the dough, increased heptane brought about higher grain scores, shorter proof times, and somewhat lower loaf

volumes at the higher heptane levels. Lard (or other fat) is therefore shown to be necessary for heptane to bring about a bread-improving effect.

The decreased proof time noted above with the use of heptane appears to be a function of increased gassing power. Gassing-power studies have shown that hexane and heptane in bread dough increased gas production by about 10% during the first two hours; loaves containing solvent were therefore bolder during proof and reached standard proofing height "prematurely" by virtue of their peaked tops. We have found that proofing a few minutes longer minimized loaf-volume loss in the solvent-containing doughs with no loss in grain quality.

The discovery of materials that improve dough is of importance since it may lead to a better understanding of the fundamentals of dough chemistry. We hope that research on the dough-improving mechanism(s) of heptane and hexane will amplify our knowledge. More details will be forthcoming from this laboratory.

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#### Literature Cited

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