A comparison of cottage cheese made with and without the use of citric acid
by Marie Burgerova

A THESIS Submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of Master of Science in Dairy Manufacturing at Montana State College
Montana State University

Abstract:
Eighty vats of cottage cheese were made by the "short time" method, and 36 vats were made by the "long time" method. Some of the vats of cheese were made with culture to which citric acid was added before inoculation. Some of the cheese was made from skim milk to which amounts of citric acid ranging from 0.002 to 0.3 percent were added before inoculation.

The volatile acids in the culture and in the cottage cheese were determined by the steam-distillation method in which one liter of distillate was titrated against N/10 NaOH, using phenolphtalein as an indicator. The number of milliliters of N/l0 NaOH required to titrate a liter of distillate was designated as the "volatile acid number".

The "volatile acid numbers" of the cultures made with the addition of citric acid to the culture milk were generally higher than those made without the addition of citric acid. High "volatile acid numbers" in the cultures did not result in high "volatile acid numbers" in the cheese made from them.

The addition of 126 F water before heating the curd compared with heating and cooking the curd without the addition of water did not influence the "volatile acid number" or the flavor of tho resulting cottage cheese.

The addition of from 0.008 to 0.05 percent citric acid to the cheese milk before inoculation increased the "volatile acid number" and the flavor of the resulting cottage cheese.

The cheese made by the "long time" method had a higher "volatile acid number" and a slightly more desirable flavor than that made by the "short time" method.

Cottage cheese curd inoculated with culture and incubated for six hours before creaming had a better flavor than cheese creamed with cultured cream or cheese to which uncultured sweet cream was added.

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TABLE OF CONTENTS

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INTRODUCTION

Cottage cheese has long been recognized as a wholesome, nutritious, and economical food. It was formerly made only in the home. As more people became aware of its food value, dairy plants started to manufacture it on a large scale. Careful, controlled methods in the plants produced a cheese of more uniform texture, body, and flavor than was possible when it was made in the home.

It has long been known that there is a good demand for cottage cheese with a pleasing flavor. Consumers are apparently more particular about the flavor than the texture or general consistency. This demand has stimulated interest in flavor research on cottage cheese. This work was undertaken in an attempt to improve the flavor in cottage cheese without interferring seriously with body and texture characteristics.

HISTORICAL

Since the skim milk coagulum from which cottage cheese is made is so similar to that of a culture which is used to improve the flavor of manufactured dairy products, it follows that the culture used to set the milk is a very important factor in the manufacture of cottage cheese with a desirable flavor.

Previous to its manufacture in the dairy plants, cottage cheese was made of raw skim milk, held at room temperature until coagulated, then cooked, drained, and salted. This method produced a product that was lacking in uniformity and in desirable flavor. It very frequently had an undesirable flavor. This indicates that a good culture having a desirable flavor is necessary in the manufacture of cottage cheese to produce the kind of flavor desired by consumers.

Hunziker (13) states that as early as 1889 Storch used pure cultures to improve the flavor of dairy products. He added pure cultures to churning cream to improve the flavor of the resulting butter.

Conn (5) studied the effect of ripening cream, previous to churning on the flavor of the butter. He pointed out that cream ripening is a complex process, and that other reactions besides souring take place. According to his findings, there should be a distinction between acid and flavor. Acid is developed from milk sugar while the aroma probably comes from other sources.

Experiments carried on by Hammer and Bailey (9), Storch (22), Boekhout and Ott de Vries (3), and Orla-Jensen (19) proved that at least two types of organisms must be present in the culture to obtain satisfactory results. These two organisms were found to be very different in their biochemical features, although their morphological and cultural characteristics were very much alike.

Hammer and Bailey (9) found that the volatile acid is an important factor in flavor development. Streptococcus lactis produced only a small amount of volatile acid, whereas a culture of good flavor showed considerably higher amounts of volatile acids.

Hammer (7) studied the types of lactic acid in culture. The presence of i-lactic acid proved the presence of other organisms than S. lactis which produces only d-lactic acid. As inactive lactic acid is a mixture of d-lactic acid and l-lactic acid, it was obvious that the other organisms produce l-lactic acid. Hammer (6) was able to isolate these organisms by inoculating lactic acid culture on agar slopes and carrying it through a number of transfers to eliminate other organisms. He named them Streptococcus citrovorus (Leuconostoc citrovorus) and Streptococcus paracitrovorus (Leuconostoc dextranicum). S. paracitrovorus produces variable amounts of l-lactic acid, reddens litmus milk, and forms a comparatively high volatile acidity. S. citrovorus does not produce lactic acid, does not redden litmus milk, and produces comparatively low volatile accidity. Both are regularly

found in a culture with a good flavor, though S. citrovorus is less numerous. Hammer described them as typical streptococci, but different in their ability to ferment citric acid to form volatile compounds. Hammer and Baker (10) found that the distinction between the two types is not a sharp one, since the amount of acid produced by S. paracitrovorus is so variable. In a study of 124 cultures of these organisms the total acidities produced in milk varied from 0.27 to 0.99 percent.

Van Niel, Kluyver, and Dorx (24) studied the relationship of acetylmethylcarbinol and diacetyl to the aroma of butter. Samples having typical aroma gave an acetylmethylcarbinol (CH_3-CHOH-CO-CH_3) reaction, while samples lacking an aroma did not. A close correlation between the high aroma and the presence of acetylmethylcarbinol was noted. However, freshly purified acetylmethylcarbinol was found to be odorless. When diacetyl (CH_3-CO-CO-CH_3) was added to butter lacking in aroma, an unmistakable aroma became apparent. These investigators concluded that diacetyl is either responsible for the flavor of butter or is the principal component of the aroma material.

Michaelian, Farmer, and Hammer (14) showed the importance of acetylmethylcarbinol and diacetyl in lactic acid cultures. Cultures having a satisfactory flavor contained comparatively large amounts of these materials, whereas cultures lacking flavor contained relatively small amounts or none at all.

Babel and Hammer (1) stated that ripening of lactic acid culture