

## 新しいタイプのフラットソー

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### Short Paper

#### A New Type of Flat Sour Spoilage\*1

Vending machines have become popular especially in the soft drink industry and recently some of the products are sold hot. However, prolonged storage of canned foods in the vending machines at the serving temperature (approximately 60°C) has caused bacteriological problems, which have not been any primary concern to the canning industry. Thermophilic spoilage microorganisms, both gas-forming and flat sour, grow well at this temperature in the vending machines. As a matter of fact, in some of the cans kept hot in the vending machines flat sour spoilage has been found.

Flat sour spoilage has been well known since about 50 years, and described to be caused by *Bacillus stearothermophilus* in low-acid foods and by *Bacillus coagulans* in acid foods<sup>1)</sup>. However, the flat sour spoilage of hot canned coffee gave no evidence of the presence of microorganisms by inoculating the spoiled products on dextrose tryptone agar (DTA) which is known to be a suitable medium for the growth of these bacilli.<sup>2,3)</sup>

When 17 kinds of canned coffee samples (12 cases of each kind were subjected to the test) were incubated for a month at 55°C, the flat sour spoilage, with flat containers, pH drop of about 1.0 from normal and very slight off-flavor, was found in 6 kinds. The spoilage ratios ranged from 0.28% to 3.61%. From the spoiled cans no colonies could be detected on DTA medium but some bacteria were detected in the fluid thioglycollate medium without indicator (indicator-free TGC).

So far as the spoiled cans tested are concerned eight strains isolated were spore-forming obligate anaerobes. These grew sparingly at 45°C and better at 65°C than 55°C, and produced acids from glucose but not from lactose, sucrose and salicin. Tests for production of indole, coagulation of milk and digestion of albumin and meat were all negative. But some of the strains reduced nitrates to nitrites and liquefied gelatin, but others did not. All the strains showed the activities of formation of hydrogen sulfide and blackening iron sulfite agar which have been thought to be the evidence of *Desulfotomaculum nigrificans*. However, these strains did not reduce sulfates in the Postgate's medium<sup>4)</sup> and in a modified indicator-free TGC in which sodium sulfite and cystine were replaced with sodium sulfate. It is difficult to determine

these strains by the Bergey's Manual of Determinative Bacteriology (Eighth Edition).

When two of the strains isolated were respectively inoculated into the normal canned coffee samples, corresponding to the respective ones from which the strains were isolated, and incubated anaerobically at 55°C, a flat sour-like phenomenon was observed after 10 to 20 days of incubation. Because  $F_0$  values of these cans at the thermal process ranged 15 to 20, the heat resistance of spores of these strains seemed to be high. As a matter of fact, when spores ( $4.9 \times 10^2/ml$ ) of one of two strains described above were heated at 120°C, the thermal death time was 25 minutes. So there is a chance that the spores survived the sterilization process.

These results indicate that the flat sour spoilage of hot canned coffee is not caused by known facultative anaerobes, but by some obligate anaerobes. If aerobic conditions are taken with DTA medium for the detection of bacteria from these flat sour-spoiled cans, no bacteria are detected. Moreover, rather drastic conditions are usually employed for sterilization of the products. So there is always the chance of erroneous estimation that the troubles with the canned coffee are caused simply by overheating both at sterilization and during high temperature incubation. It would be better that good care is taken as to the canned foods sold in preheated conditions.

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