

On Bacillus Natto.

BY

Shin Sawamura.

Natto is an article of food prepared by leaving boiled soy-beans wrapped in rice straw in a warm place for a night, and thus making them ferment. Soy-beans of natto are coated with a characteristic slimy substance. The author¹ separated formerly two species of bacilli from natto obtained in Tokyo, No. 1 of which produced good flavored natto when inoculated to boiled soy-beans, and No. II strongly slimy one. The former bacillus was considered to be the chief actor in natto fermentation and received the name of "*Bacillus natto*." In later years the author examined bacteriologically many samples of natto obtained at various localities, and found that the producer of natto is the same in all cases, viz. "*Bacillus natto*." This bacillus can produce natto of good flavor and strong viscosity, and the presence of other microbes is not necessary in the fermentation of natto. The bacteriological description of *Bacillus natto* is as follows.

Form: The bacillus measures 1 μ in width and 2-3 μ in length. The ends of the rod are round and the bacilli unite in two or more.

Mobility: Motile.

Spore-formation: The bacillus forms a spore mostly in the middle of the cell.

Gram's method: It is not decolorized by GRAM'S method.

Oxygen: Aerobic.

Bouillon: It produces a light brown, thin, characteristic dry mealy scum which is broken into pieces by shaking. Bouillon does not become turbid.

1. Bulletin of Agricultural College, Tokyo, Vol. VII, p. 107.

[Jour. Coll. Agric., Vol. V, No. 2, 1913.]

Pepton water: The scum formation is the same as in bouillon, but its color is lighter.

Agar plate culture: The colony is light brown and flat, and has a characteristic dry mealy appearance, with a small point in the centre of the colony, the periphery of which is irregular and divided feather-like. It produces a smelling of natto.

Gelatine plate culture: Small colonies are formed which liquefy gelatine quickly.

Agar streak culture: It produces a light brown flat and characteristic dry mealy colony.

Gelatine streak culture: It is quickly liquefied along the needle track.

Agar stab culture: It grows only along the needle track and forms no branch.

Gelatine stab culture: It is liquefied along the needle track.

Soy-bean agar: The colony has folds and is rougher than on bouillon agar.

Potato: Gray slimy colony with many folds, resembling that of potato-bacillus.

Gas: It is not evolved in glucose bouillon.

Azolithmin-milk: It is reddened at first, and then decolorized, and the milk becomes clear. After many days azolithmin turns somewhat blue when it is newly added.

Indol: Pepton water culture kept at 32° C for 7 days gives the characteristic reaction, neither with $NaNO_2$ and H_2SO_4 , nor with nitroprussic acid and $NaOH$.

H_2S : It is not formed.

It was confirmed by the previous investigation that *Bacillus natto* produces a trypsin-like enzym, and decomposes protein of soy-beans. In order to know how protein is decomposed by this bacillus, boiled soy-beans were inoculated with this bacillus and kept at 35° C, one sample for 14 hours and the other for 7 days. The viscosity and flavor of natto thus prepared are stronger in the younger than in the elder.

The nitrogen in various forms and soluble organic matter in the percentage of dry matter were found to be as follows:—

	14 hours	7 days
Total nitrogen	7.363	7.421
Insoluble albuminous nitrogen	5.881	2.104
Soluble " "	1.482	5.317
" coagulable " "	0.307	0.182
" uncoagulable " "	0.321	0.477
Nitrogen of pepton and polypeptides	0.208	0.408
" " arginin, histidin and lysin	0.069	0.085
" " purin bases	0.086	0.140
" precipitated by phosphotungstic method ..	0.109	2.111
Soluble organic matter	21.947	41.546

Soy-bean contains nitrogen chiefly in the form of protein (85-90%), non-albuminous nitrogen being very little (10-15%).

Bacillus natto produces diastase, but reducing sugar was not found in natto thus prepared. This is probably due to the fact that soy-beans do not contain much starch, the main part of carbohydrate being in the form of galactan, &c, wherefore the little glucose formed was decomposed again by the bacillus.

The author expresses hereby sincere thanks to Mr. OSHIMA, assistant of the College, who analysed natto as above mentioned.