Screening and Characterization of Phosphate Solubilizing yeasts from Korean fermented foods

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Introduction. Phosphorous is one of the major essential macronutrients for plants, which is applied to the soil in the form of phosphatic manure. However, a large portion of the applied phosphorous is rapidly immobilized, being unavailable to plants (1). The excessive fertilization of phosphorous leads to soil erosion and runoff water and cause environmental problems (2). Many bacteria and fungi are known to solubilize phosphate in soil complexes, rendering phosphorous available to plants, but only a few species of yeast are known with phosphate solubilizing ability.
To develop biofertilizer and biodegradation agents, phosphate solubilizing yeast strains were isolated and characterized. The analysis of phosphate solubilizing related genes is now under investigation.

Methods. The phosphate solubilizing yeasts were screened on the agar media supplemented with tricalcium phosphate (TCP). The yeast strains were identified by 26S rDNA domain D1-D2 sequence analysis (3). The temperature and pH range for growth and salt tolerance were tested for analysis of physiological characteristics. The phosphate solubilizing ability was determined concentration of phosphorus released from TCP and pH drop in liquid culture.

Results. Of 1,100 yeast strains which were isolated from various Korean fermented foods, screened for phosphate solubilization, five strains showed the ability to solubilize TCP. The 26S rDNA domain D1-D2 sequence analysis revealed the identification of D1-1 as *Candida versatilis* (100% similarity), M10-2 and N8-1 as *Pichia anomala* (100 and 99.8% similarity, respectively), N15-10 as *P. farinosa* (100% similarity), and G3-1 as *P. subpelliculosa* (100% similarity) (Fig.1). All the strains showed mesophilic characteristics. The temperature range for growth was 20-35^{o}C and N15-10 was able to grow at 40^{o}C. Four strains except D1-1 were able to grow at pH range of 4.0-8.0. Strain D1-1 was able to grow at pH5.0-6.0. The strains have tolerance to 10% of NaCl concentration and strain D1-1 showed halophilic characteristics. The phosphate solubilizing activity was estimated differently depend on strains and incubation time, and its extent was negatively correlated with pH of the culture. The strain G3-1 showed higher drop in pH and phosphate solubilizing activity compared to the others. It solubilized 697 ug/mL of phosphorus from TCP with decrease in pH from 6.8 to 4.4 after 11 days of inoculation. The maximum concentration of solubilized phosphorus and pH drop by strain M10-2, N8-1, N15-10, and D1-1 were 441 ug/mL (pH5.3), 453 ug/mL (pH5.3), 555 ug/mL (pH4.9), and 653 ug/mL (pH4.7), after 3, 2, 7, and 13 days inoculation, respectively (Fig. 2).

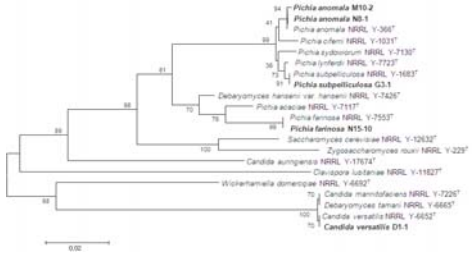

Fig.1. Phylogenetic positions of P-solubilizing yeast strains based on the 26S rDNA domain D1-D2.

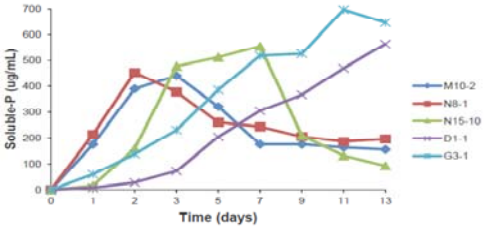

Fig.2. Changes of free phosphorus concentration during the cultivation of yeast strains.

Conclusions. The five strains of phosphate solubilizing yeasts were selected and identified as *C. versatilis*, *P. anomala, P. farinosa*, and *P. subpelliculosa*. Of five strains, *P. subpelliculosa* G3-1 showed most active in solubilizing phosphate. It's solubilized 697 ug/mL of phosphorus after 11days.

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