Screening for phytase-producing bacteria from hydrothermal environments

Stefanie Gabler[1], Nitza Inostroza[2], Jacquelinne Acuña[2], Daniel Menezes-Blackburn[3], Ralf Greiner[1] and *Milko Jorquera*[2]

[1]Max Rubner-Institut, Federal Research Institute of Nutrition and food, Karlsruhe, Germany
[2]Scientific and Technological Bio-resource Nucleus, Universidad de La Frontera, Temuco, Chile, email: nitza.inostroza@gmail.com
[3]Lancaster Environment Centre, Lancaster University, Lancaster, UK.

Phytases are ecologically important enzymes involved in the organic phosphorus cycling in nature. These enzymes are widely used as feed additives to improve mineral bioavailability in animal diets [1]. For their biotechnological application, thermal tolerance is, among others, a desired property of phytases. However, so far thermal tolerance has scarcely been included into phytase-screening programs. The objective of this study was isolate and characterize thermo-tolerant bacterial phytases from Chilean hydrothermal environments (Liquiñe hot-spring [39°44′S; 71°51′W] and El Tatio geyser [22°19′S, 68°0′W]). Screening of 69 thermo-tolerant (60ºC) culturable bacteria was carried out and the strains *Bacillus* sp. 9B and *Geobacillus* sp. 15 were selected and identified (16S rRNA gene) as producers for intra- and extracellular phytases. The results also indicate that both strains are able to synthesize more than one individual phytase. The characterization of intracellular phytase revealed that *Bacillus* sp. 9B produces phytase that shows an optimum pH at 5.0. This result suggests a novel property for phytases from genus *Bacillus* which are mostly characterized by ß-propeller phytases with optimal pH in the range of 6.5 to 8.0. An optimum at pH ~5.0 is known for other phytase classes such as histidine acid phosphatase and purple acid phosphatase [2]. The strain *Geobacillus* sp. 15 also produces phytase that shows optimum pH at 5.0, but with an unusual residual activity at low pH (12% and 30% at pH 1.0 and 4.0, respectively). Most microbial phytases are inactive at low pH, except *Aspergillus niger* and *Escherichia coli* phytase [3,4]. The characterization of an acidic thermo-tolerant phytase produced by *Geobacillus stearothermophilus* from hot-spring has recently been reported [5]. The temperature optimum for phytate dephosphorylation was determined to be 60°C for the phytase from *Bacillus* sp. 9B and 50°C for the *Geobacillus* sp. 15 phytase. Interestingly, the phytase from *Geobacillus* sp. 15 shows a residual activity of 46% after incubation at 90ºC for 20 min. Our study demonstrates that Chilean hydrothermal environments represent an unexplored source of novel thermo-tolerant bacterial phytases with more favorable properties for biotechnological applications, for example in food processing or as feed additives.

References:

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