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Soil proteomics

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Proteomics is a post-genomic field and concerns the integrative analysis of proteins in biological systems. A typical proteomic experiment involves: 1) the separation and isolation of proteins from a cell line, tissue or organism; 2) the acquisition of protein structural information for the purposes of protein identification and characterization; and 3) data base utilisation. The predominant technology for protein separation is polyacrylamide gel electrophoresis. Usually two-dimensional electrophoresis (2-DE), which involves the separation of proteins by two distinct properties, is used for characterising a complex protein mixture. Microbial proteomics has so far been dominated by axenic cultures and environmental applications of proteomics research are still in the infancy.

In soil from 30 to 45% of the total soil N is probably present as protein N, mostly being adsorbed and protected by soil colloids, whereas microbial N only accounts for 4% of the total N. By considering the N distribution, possible applications of proteomics in soil could involve functional and structural proteomics. The aim of the former might be the quantitative studies of protein expression between samples that differ by a variable. It should reflect the activity of microflora and could be combined with studies on DNA and mRNA characterisation. One of the critical points of this approach could be the extraction of microbial proteins from soil due to the high background of extracellular and stabilised proteins. Probably this problem could be circumvented by using an indirect extraction method, with separation of microbial cells from soil colloids and successive extraction of proteins from the separated microbial cells. Once the microbial proteins have been extracted from soil they can be characterised as it is normally done in axenic cultures.

The aim of the soil structural proteomics is to understand the location and stabilisation of extracellular proteins in soil. Several humic enzyme (urease, phosphomonoesterase

and proteses) complexes have been extracted from soil by 0.1 M sodium pyrophosphate at pH 7.1; these complexes have been fractionated by ultrafiltration and then by gel filtration. It has been shown that larger molecular weight complexes are more resistant to thermal denaturation and proteolysis. Two hypotheses have been proposed to explain such a resistance. Enzyme-humic complexes of higher molecular weight are more likely to possess molecular arrangements which confer similar protection to the bound enzyme. The other hypothesis concerns the presence of glycoenzymes in these fractions because higher carbohydrate contents were observed in the larger than in the lower molecular weight fractions.