Microbial degradation of three isomeric mononitrophenols

There are three isomeric mononitrophenols: ortho-nitrophenol (ONP), meta-nitrophenol (MNP) and para-nitrophenol (PNP). Their wide application has led to the accumulation of nitrophenols as contaminants in the environment. This talk will present the biochemistry and genetics of microbial degradation of three nitrophenol isomers including their chlorinated derivatives. Pseudomonas sp. strain WBC-3, Cupriavidus necator JMP134 and Alcaligenes sp. strain NyZ215 are able to utilize PNP, MNP and ONP, respectively, as a sole source of carbon, nitrogen and energy. The underlying degradation mechanisms at both genetic and biochemical levels have been elucidated for each of these three strains. It has been shown that pnpA-encoded PNP 4-monooxygenase, mnpA-encoded MNP nitroreductase and onpA-encoded ONP 2-monooxygenase catalyze the initial reactions of PNP, MNP and ONP catabolism, respectively, with concomitant release of nitrite, ammonium and nitrite, respectively. A transcriptional regulation study demonstrated that the transcription of three PNP catabolic operons were activated by two LysR-type transcriptional regulators PnP and PnP in strain WBC-3. During the investigation of 2-chloro-4-nitrophenol (2C4NP) degradation, the catabolism pathway was found to be initiated by a two-component para-nitrophenol monooxygenase in Gram-positive Rhodococcus imtechensis RKJ300 and by a single component monooxygenase in Gram-positive Burkholderia sp. strain SJ98. In strain RKJ300, the dechlorination during 2C4NP degradation occurred before ring cleavage but it did after ring cleavage in strain SJ98.