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## **Chitinase gene from *Bacillus licheniformis* and characterization of expression in *E. coli***

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We cloned chitinase genes from *Bacillus licheniformis* N1 strain showing high antifungal activity and CH-1 strain possessing chitinase activity isolated from upland soil sample. The CH-1 strain was identified as *Bacillus licheniformis* CH-1 by analysis of 16S rDNA sequences. The chitinase genes of the N1 strain and the CH-1 strain were cloned by PCR using PCR primers based on chitinase gene sequence of *B. licheniformis* TP1. Two chitinase genes exhibited 96% protein sequence identity by Clustal W analysis. The nucleotide sequence of two genes revealed a single open reading frame encoding 598 amino acids with an expected molecular mass of about 66 kDa. The deduced amino acid sequence of chitinase gene appeared to have three functional domains, such as catalytic domain (amino acid residues 44 to 433), fibronectin typeIII like domain (amino acid residues 460 to 541) and chitin-binding domain (amino acid residues 551 to 580). Recombinant *E. coli* Top10' harboring the cloned chitinase gene (pCHI-N1 and pCHI-1) showed chitinase activity on media containing colloidal chitin. Among two chitinases, N1 chitinase was overexpressed driven by T7lac promoter in *E. coli* BL21 by pET42-a vector. The reconstruction of biocontrol agent *B. amyloliquefaciens* A-2 to improve biocontrol efficacy is in progress by introducing the cloned chitinase gene into the strain A-2.