inducers. The increased xylanase production yield and a selective xylanase induction with concurrently low cellulase activity in various microorganisms are the consequences of the use of such substrates. Other alternatives have to be well thought-out for large scale processes owing to their cost. Some lignocellulolytic substrates like barley husk, corn cobs, hay, straw or wheat bran have been compared with pure substrates and a little of them performed appreciably better than isolated xylans or celluloses with regard to xylanase yields in large scale production. There are a series of fermentation conditions that may affect significantly both the yield of xylanases and the concomitant production of cellulases in the medium. The most important conditions whose optimisation has improved xylanase production are pH value, temperature, oxygen saturation and even the agitation of the culture broth. When the stirrer was turned off following a definite cultivation time and then used only at regular intervals, highest xylanase activities were obtained in a 20 m3 fermenter.

Solid State Fermentation processes are useful for intricate substrates including forestry, agricultural, and food processing residues that are used as inducing carbon sources for xylanase production. Contrary to most bacteria and yeast, fungi have the ability to grow at reasonably low water activities that make them appropriate for SSF conditions. In addition to higher enzymes titres than smF, enzymes properties like pH tolerance and thermostability are also improved when SSF is the production procedure. Physiological growth differences like substrate conversion and enzyme to biomass ratio explain why filamentous fungi have lower yields in SmF compared to SSF (Viniegra-Gonzalez et al 2003; Aguilar et al 2004). SmF are generally preferred as a production process when more purified enzymes are needed whereas synergistic effects from a xylan degrading enzymes sequence was easily found in those obtained in SSF using complex substrates.

The isolation of overproducing mutants was another way to enhance xylanase production and reduce the enzyme cost. Singh et al (1995) isolated a

**APPENDIX 2**

**RESTRICTION MAPPING OF XYN 2**
Stability at the extremes of pH was branded by a spatially biased allotment of charged residues. The acidophilic and acid stable xylanase from *A. kawachii* is characterized by an acidic residues concentration on its surface (Fushinobu et al 1998) that is believed to trim down electrostatic repulsion of the positively charged residues at low pH. Quite the reverse, enzymes stable in alkaline conditions are typically characterized by a decreased number of acidic residues and an increased number of arginines. A correlation between pH activity and the number of salt bridges with acidophilic xylanases exist in family 11 xylanases (Hakulinen et al 2003). High pH adaptation could occur through an analogous mechanism to high temperatures adaptation (Hakulinen et al 2003).

1.2.4 Xylanase sources and production

Every type of xylanases has been found in a wide variety of living organisms, including marine and terrestrial bacteria, rumen bacteria, fungi, marine algae, protozoa, snails, crustaceans, insects, terrestrial plants and their seeds. On the other hand, because of the fact that they ooze xylan degrading enzymes into the medium removing the cell disruption requirement before purification, filamentous fungi are mainly interesting xylanase producers from an industrialized attitude (Sunna & Antranikian 1997; Polizeli et al 2005). Xylanase levels from fungal cultures are classically a lot higher than those from bacteria or yeast. Other than xylanases, fungi generate numerous supplementary enzymes necessary for the substituted xylan degradation. Actually xylanase produced by submerged fermentation (SmF) accounts nearly 90% of total global xylanase (Polizeli et al 2005). However, a considerable interest in using solid state fermentation (SSF) techniques to manufacture xylanases from fungal origins is also there.

The successful production of xylanases depends greatly on the choice of the substrate. Purified xylans are outstanding substrates in view of the fact that low molecular weight compounds made from them are the preeminent xylanase substrates in view of the fact that low molecular weight compounds made from them are the preeminent xylanase.