면섬유의 기존 전처리 공정과 효소 사용 전처리 공정의 환경오염 평가

최은경, 손승환, 조영달

섬유환경분석실, 한국생산기술연구원, 천안시

Environmental Impact from Enzymatic Preparatory Process of Cotton: Comparison with the Conventional Process

Eun Kyung Choe, Seung Hwan Son, Young Dal Cho

Textile Ecology Laboratory, Korea Institute of Industrial Technology, ChonAn, Korea

1. Introduction

At the time of facing strict environmental regulations, environmentally friendly dyeing technology is being highlighted due to the potential possibility of reducing environmental impact, so is the preparation process that uses a great deal of water and generates as much contamination. Enzyme technology has been regarded as an eco-friendly solution to industrial problems, saving water, chemicals and energy. There is an increasing number of reports regarding the use of enzymes in textile wet processing of natural fibers, particularly cottons. A variety of enzymes that are important for textile applications include amylases, amyloglucosidases, cellulases, proteases, lipases, and pectinases, glucose oxidases in the area of desizing of cottons and jeans, bio-finishing of cellulosic fabrics, denim washing, scouring of cottons, shrink-resist finishing of wools and detergent additives as stain remover or optical brighter. Some applications have already been widespread use in textile mills.

Recently Novo's pectinase scouring which is evaluated to be economical with low dosage becomes more of an issue for a new alternative scouring process for cotton with at least equivalent effectiveness and significantly reduced environmental impact including less consumption of water and energy and reduction of BOD/COD/TDS load.

In the present study, we would like to evaluate the ecological properties of chemicals and enzymes, biological alternatives and to compare environmental impact of conventional and new enzymatic processes particularly in terms of organic pollution. The conventional highly alkaline preparatory process of cotton

that is an example for one of the most negative environmental impacts is chosen with its alternative enzymatic desizing and scouring processes. This study also focused on developing a method for estimating water pollution from process recipes.

2. Experimental

2.1 Chemicals, Enzymes and Preparatory Recipes

A typical cotton dyeing company in Korea was chosen to provide all chemicals used in its conventional preparation of cotton with a recipe. Since enzymatic desizing was, in some cases, carried out in this company, enzyme and surfactant auxiliaries for desizing were also collected through the same company with another recipe for preparation. A recipe for enzymatic scouring was followed according to the recently reported paper[1] since it is not commercially widespread yet. A new enzyme product for this use was obtained by Novozymes.

2.2 Measurements

The 5-day biological oxygen demand (BOD_5) , chemical oxygen demand (COD) using open reflux-titrimetric method, total organic carbon (TOC) using combustion-IR detection were measured with chemicals and enzymes according to the analytical methods described in [2,3] (Part 5210 B, Part 5220 B, Part 5310 B). The same parameters were measured with a desizing effluent sample. Each measurement was made with three replicates per each sample. A proper dilution factor was 1000 for chemicals and enzymes and 100 for a disizing effluent.

The FT-IR spectra of chemicals were measured using ZnSe horizontal ATR accessory of PIKE Technologies, Inc and FTIR spectrophotometer of Perkin Elmer 1760X. About 2mL liquid sample was placed using a Pastuer pipet into a trough-shaped holder without any special sample preparation. Background scanning was done with no sample on the face of the crystal.

3. References

1. J.N.Etters, *Textile Chemist and Colotist,* 1(5), 22(2001).

2. Standard Methods for the Examination of Water and Wastewater, Part 5210, Part 5220, Part 5310, 19th Ed. American Public Health Association, Washington, D.C., 1995.

3. R.A. Corbitt, Standard Handbook of Environmental Engineering, R.A. Corbitt (Ed.), Chap.6, McGraw-Hill, Inc, New York, 1990.

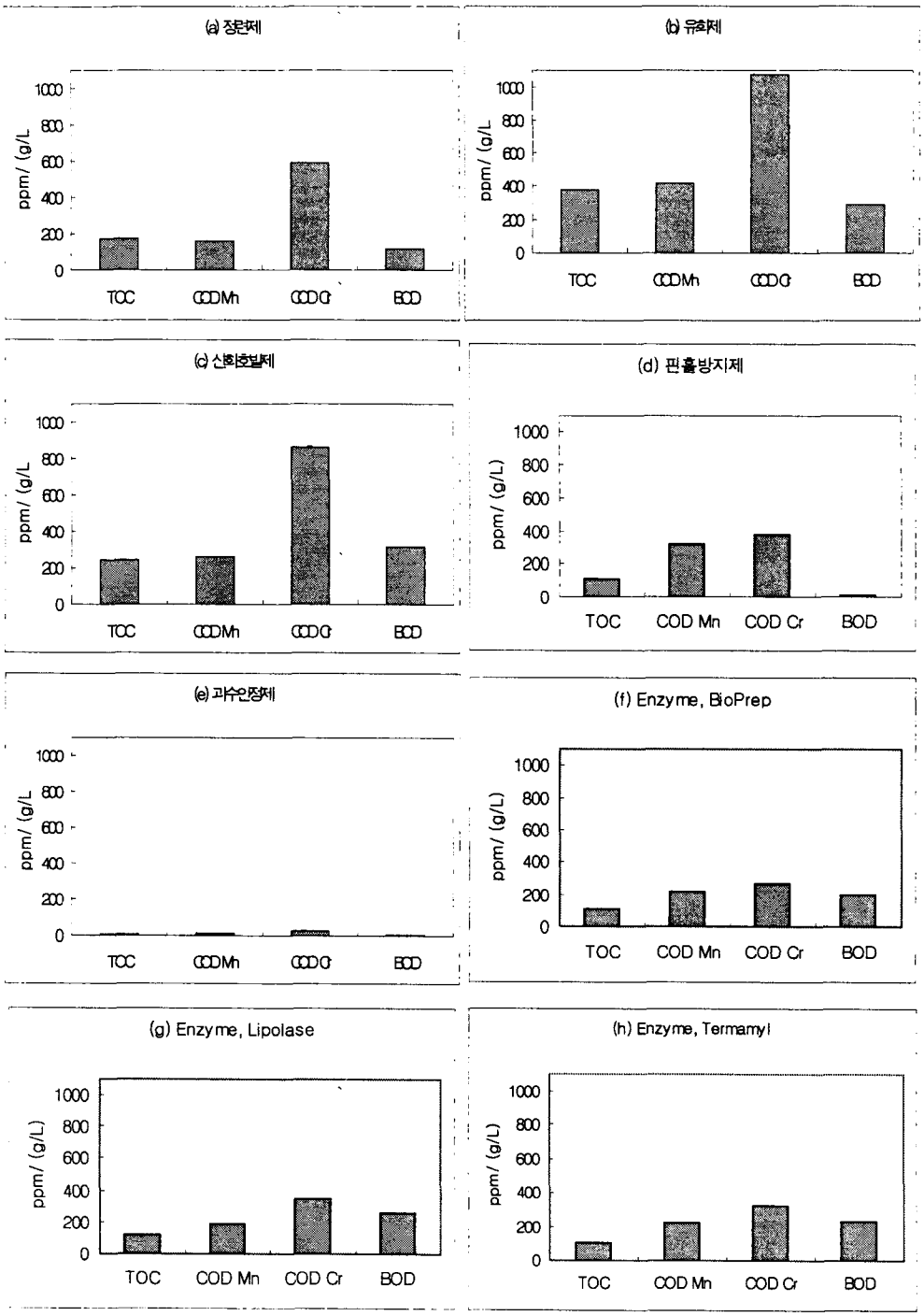
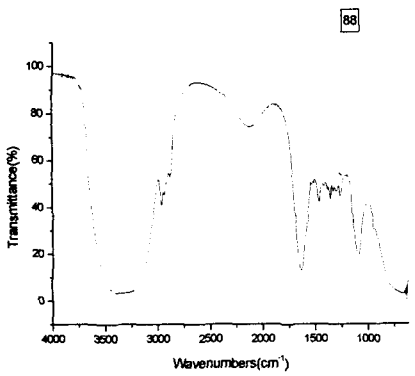
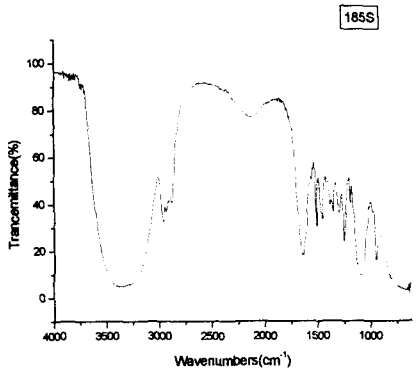


Figure 1. Comparison of ecological values of chemicals and enzymes used in the preparation of cotton fabric.

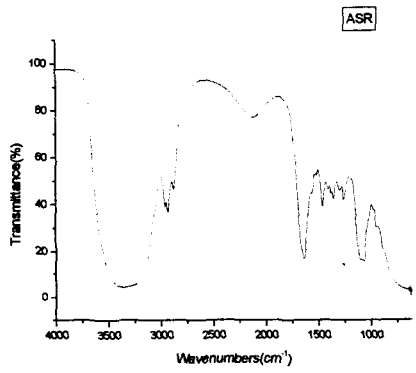
(a) 정련제



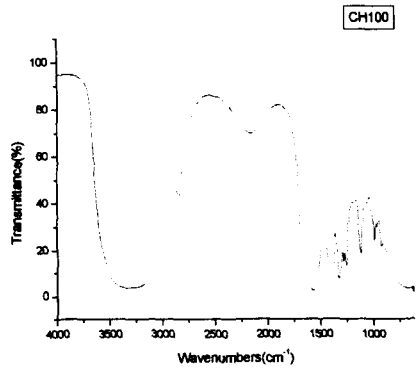
(b) 유화제



(c) 산화호발제



(d) 핀홀방지제



(e) 과수안정제

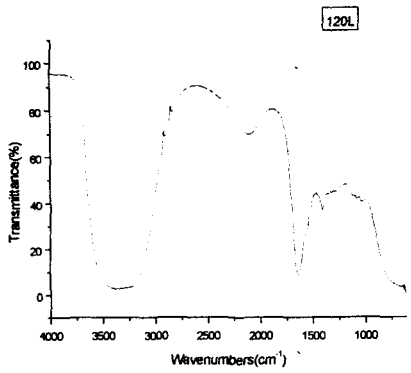


Figure 2. FTIR spectra of chemicals used in the conventional preparation of cotton fabric.