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Ultrasonic assisted industrial wool scouring

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Abstract

The work has shown that modification of the traditional wool scouring line by introducing an ultrasonic device could be a viable alternative for wool scouring industry. A standard six bath wool scouring line was retrofitted with two ultrasonic panels working at 80 kHz in bath 2. Scouring was carried out in three modes: conventional mode without the transport rake, ultrasonic mode without the transport rake, and conventional mode with the transport rake. Ultrasonic scouring was found to improve removal of grease and ash from the wool fibres.

Keywords: Wool, wool scouring, ultrasonics, retrofitting, industry;

1. Introduction

Research has found that the wool production process can be improved by the use of ultrasonic irradiation during raw wool scouring [1-5]. By adapting appropriate ultrasonic settings, improvement in an effective and environmentally friendly process of wool scouring can be achieved in a number of ways: A lowered cleaning temperature within the baths, hence a reduction in energy required for scouring [1]; A significant reduction in the amount of detergent and chemicals needed for the cleaning [2], hence a reduction in toxicity of the effluent from the cleaning process, and in the chemicals present in lanolin produced. A reduction in entanglement of the fibre that causes breakage and waste during yarn manufacture [4]. An enhanced fibre dye uptake results from the changes of fibre cuticle structure during ultrasonic scouring [5].

Much of the work however, has been conducted at laboratory scale. Research into industrial practice of ultrasonic aqueous wool cleaning is still underway despite a success in the technology being used in other textile industries [6,

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7]. This study makes an attempt to adapt ultrasonic assisted industrial wool scouring. The aim of this work is to develop and optimise a new wool scouring system, which has the potential to reduce water and energy consumption, and to improve wool scouring productivity.

In this work, specially designed ultrasonic devices have been manufactured to enable a retrofit to the existing conventional scoring line to undertake the new production technique. The industrial trial extends laboratory studies where the initial ultrasonic settings for wool scouring have been obtained. The outcome of this study is expected to provide the wool industry with valuable information on the environmentally friendly use of ultrasonic energy in achieving good fibre quality.

2. Samples and trials

2.1 Wool sample

The wool used in this work was Australian merino wool grown in the Western District of Victoria, Australia. Bale specification: 175 kg net, 18-20μm mean diameter, 18% coefficient of variation, 0.3% vegetable matter, and 64.5% scouring yield.

2.2 Ultrasonic retrofitting

A typical plant layout for a scour of fine wool shown in Figure 1 is used in this work. shows a hopper-bottomed scour bowl.The optimum temperature depends on the actual detergent used and is usually within the range 50 – 65 °C. Where alkaline scouring conditions are employed, temperatures less than 55°C should be used [8]. Two ultrasonic panels made from stainless steel were added to the scouring bowl of bowl 2 (Figure 1). Processing variables remained unchanged. Ultrasonic devices used in this project were specially designed and were made for the scouring line being adapted.

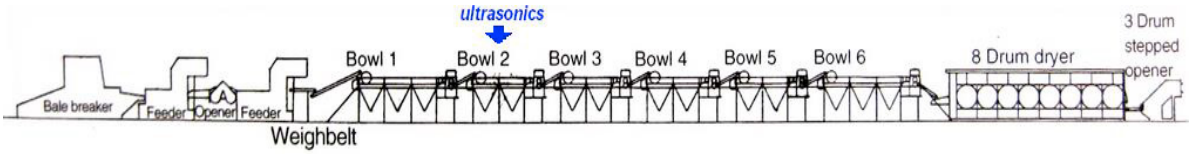

Fig. 1. Scouring plant for fine wool

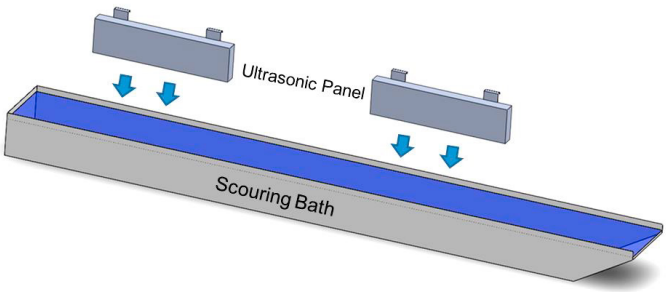

Fig. 2. A schematic diagram of ultrasonic setting