Waterless Textile Wet Processing Technology

Waterless Dyed Fabric



The textile wet processing industry is believed to be one of the biggest consumers of water and energy. Huge amounts of water are required for processing of fabrics with various kinds of chemicals and auxillaries. It includes desizing, scouring, bleaching, dyeing, printing and finishing etc. All of these stages requires aqueous medium i.e. water. On average an estimated 100 kg of water is needed to process 1 kg of textile material. At the end of the process, this water contains large quantities of chemicals, salt and alkali, and becomes chemical waste, which is difficult to treat also leading to large amounts of untreated wastewater directly being dumped in water bodies. All these wet-chemical processes are also one of the fundamental sources of environmental pollution due to the discharge of large amounts of wastewater to the environment. Water scarcity and increased environmental awareness are world-wide concerns which are causing a sharp rise in prices for intake and disposal of water.

For many years, the textile industry has tried to identify new ways to reduce the water consumption and the wastewater discharge in the industry, such as machine modification (use of low liquor ratio machines), process modification (combined processes), reuse of water and ZLD processes. Although there have been efforts to reduce the water input, water usage is still high in the textile industry. The textile wet processing industry is today interested in newer technologies which can address both effluents as well as ecofriendly process.

Supercritical Carbon Dioxide processing of textiles is seen as an interesting alternative to the conventional water based processes. Elimination of the water process and chemicals will be a significant breakthrough for the textile processing industry. This new process utilize supercritical carbon dioxide as solvent which is a completely waterless process using only nominal amounts of CO_2, nearly all of which is recycled. Excess dye at the end of the process can be separated.

Environmental benefits like no water usage, no wastewater generation, thus no effluent treatment required.

SASMIRA, under the Ministry of Textiles sponsored Project, has developed a prototype of supercritical carbon dioxide (SC-CO_2) dyeing of textiles with a capacity of 20 litres dyeing vessel to establish textile wet process. The developed prototype is a distinct set-up exclusively for carrying out the dyeing of fibres/fabrics using SC-CO_2 technology. The dyeing vessel in the developed prototype is based on unique design meant for processing of various textile substrates with uniformity.In this set-up, the supercritical carbon dioxide dissolves and carries the dye onto the fibre/fabric thus facilitating water-free dyeing. Extensive trials were conducted for standardizing the process parameters of SC-CO_2 textile set-up.The process parameter studied was interms of required pressure, temperature, flow rate of $CO_2$and duration of time. The developed prototype of SC-CO_2 textile dyeing system has been automated with PLC system though PLC – SCADA control system with HMI & control panel.

Waterless dyeing technology using supercritical carbon dioxide (SC-CO_2) can provide solution to the textile wet processors. This technology eliminates usage of water and chemicals and is a breakthrough for the textile processing industry.

Salient features of developed SC-CO_2 set-up for textile dyeing

- Water free dyeing
- No waste water discharge hence no effluents
- Elimination of drying process
- Recycling of the carbon dioxide
- Green and clean process
- Collection of unused dye

Patent filed on 31st July 2015 vide Application No. 2896/MUM/2015 entitled "Supercritical carbon dioxide (SC-CO_2) textile dyeing vessel for dyeing of textile substrate in fibre/fabric form". Publication date of Patent is 2017. First Examination report replied on 28thJanuary 2020.

Contact Details

The Synthetic & Art Silk Mills' Research Association (SASMIRA)
Sasmira Marg, Worli,
MUMBAI - 400 030, INDIA
Tel: +91-22-24935351
Email: project@sasmira.org
Website: www.sasmira.org