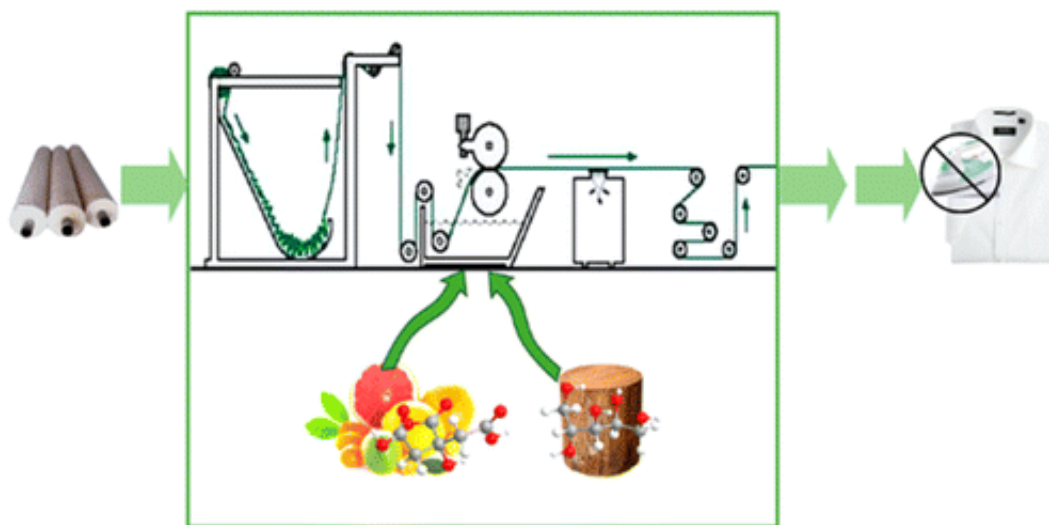


# Creating 'greener' wrinkle-resistant cotton fabric

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Ironing is a tedious chore, but wearing crumpled clothing is unprofessional. That's why "wrinkle-resistant" garments have become so popular. But the current methods for making these textiles often release formaldehyde - a chemical that in large amounts is hazardous to human health - into the air and water. Now a team reports in *ACS Sustainable Chemistry & Engineering* a method for making wrinkle-resistant cotton fabrics that is more environmentally friendly and cost effective.

Manufacturers typically use a chemical process called cross-linking to create textiles that are less likely to wrinkle. But these methods often

involve agents that contain a significant amount of the hazardous chemical formaldehyde. This substance can leak from the clothing during the manufacturing, wearing or washing of clothes, and this has raised environmental and health concerns. Other processes have been developed, but they either still include formaldehyde, or they are exorbitantly expensive. Yiqi Yang and colleagues wanted to develop a cross-linking method that could create wrinkle-resistant cotton [clothing](#) that overcomes these challenges.

The team investigated several chemicals that had been shown to have wrinkle-resistant properties without requiring formaldehyde. They then tested different combinations of these chemicals. The best results were obtained by cross-linking citric acid with xylitol. Citric acid is a mediocre anti-wrinkling agent, and it tends to yellow fabrics. But when cross-linked with xylitol, the discoloration is mitigated and the anti-wrinkling effect is improved. This citric acid/xylitol combination is made entirely of renewable raw materials, making it environmentally friendly. The researchers also demonstrated a scale-up method that is more cost-effective than other "green" options and is cost-competitive with [formaldehyde](#)-based approaches currently used by textile manufacturers.

**More information:** Jian Liu et al. Green Finishing of Cotton Fabrics Using a Xylitol-Extended Citric Acid Cross-linking System on a Pilot Scale, *ACS Sustainable Chemistry & Engineering* (2016). [DOI: 10.1021/acssuschemeng.5b01213](https://doi.org/10.1021/acssuschemeng.5b01213)

## Abstract

Cross-linking is frequently applied to cotton fabrics for enhanced wrinkle recovery and dimensional stability. The combination of citric acid (CA) and xylitol shows great potential as a sustainable alternative to the market-dominating N-methylol resins, which are inherently formaldehyde-releasing. This paper reports a successful pilot-scale

application of this green cross-linking system preceded by systematic investigation using response surface methodology (RSM). Responses of fabric properties to five foremost variables were investigated to gain insight of the cross-linking system and facilitate its industrialization. The model obtained by RSM suggests that curing temperature is the most prominent variable and the responses to CA and xylitol concentrations are closely coupled. The optimum conditions used for the pilot-scale experiments were 3 min, 175 °C, 130 g/L, 15 g/L, and 3 kg/cm<sup>2</sup> for curing time, curing temperature, CA concentration, xylitol concentration, and padder-roll pressure, respectively. The CA/xylitol finished fabrics were comparable to those finished with the market-dominating dimethyloldihydroxyethyleneurea (DMDHEU) resins. Analyses show that CA/xylitol is more cost-effective than other formaldehyde-free cross-linking agents and clearly has a more preferable environmental, health, and safety (EHS) profile than DMDHEU. The encouraging results indicate that CA/xylitol has great potential in replacing N-methylol resins on an industrial scale.

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