

EASTMAN

Eastman CAB-551-0.01
provides easier removal
of LED-cured nail polish



Eastman
cellulose esters

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The use of LED- and UV-cured nail polish has grown rapidly in recent years, and in addition to professionally applied nail products, similar products are now available for home application. The use of energy-curable nail polish materials offers significant advantages over conventional solventborne products, most notably in the almost instant drying time once exposed to light of a suitable wavelength for curing. A further significant advantage of LED/UV cure is the durability of such products which, if applied correctly, can last in excess of 7 days without chipping or damage. While this resistance to physical damage is a positive feature of this technology, it also leads to one of the major problems with such nail products, notably the difficulty the wearer has removing the product. Mild nail polish removing solvents often have little or no effect on the cured nail polish, and even more active solvents, such as acetone, need to be used for extended periods by either wrapping the nails with solvent-soaked materials or complete immersion in the solvent. Health issues associated with prolonged exposure to strong solvents, such as acetone, are well documented and can lead to long-term problems, such as contact dermatitis, and physical damage of the nail plate itself, such as drying and removal of protective natural oils. Further health issues related to the ability of unreacted monomer in the nail composition, aided by solvent, to absorb into the skin have also been hypothesized; therefore, it is recognized that prolonged exposure to solvents should be avoided.

This technical tip illustrates how the use of a non-LED-curable resin, such as Eastman CAB-551-0.01, can help to significantly reduce the solvent-soak removal time of an LED-cured nail polish top coat system, minimizing the exposure time to strong solvent while not compromising the physical properties of the nail polish.

Experimental

A commercial, unpigmented LED-cured nail polish gel coat was obtained from a leading European manufacturer. Using a high-shear mixer, 9 wt% of Eastman CAB-551-0.01 was added to this product. CAB-551-0.01 was chosen because it is the cellulose ester with the lowest molecular weight and would be expected to have the least influence on viscosity.

Films of the cellulose-ester-containing formulation were drawn down on glass panels at 100 μm film thickness using a cube applicator and cured for 120 seconds using a portable LED nail polish lamp operating at a wavelength of 395–405 nm.

Once cured, the films were assessed for:

- Time for the film to be removed by immersion of the coated panel in acetone
- Gloss using a multiangle gloss meter
- Hardness development over a 14-day period using a pendulum hardness development tester.

Results

Figure 1. Acetone soak removal time

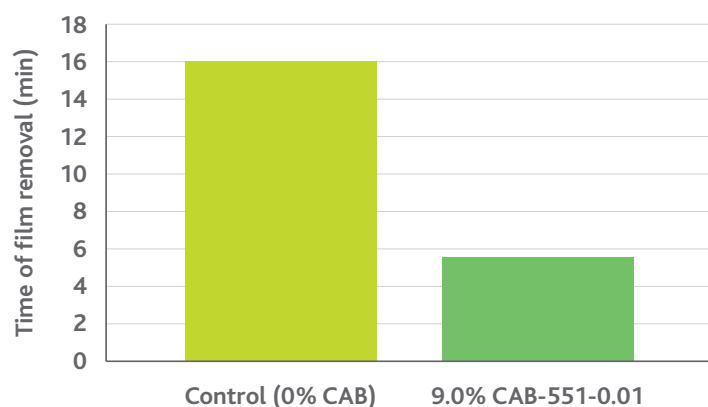


Figure 2. Gloss

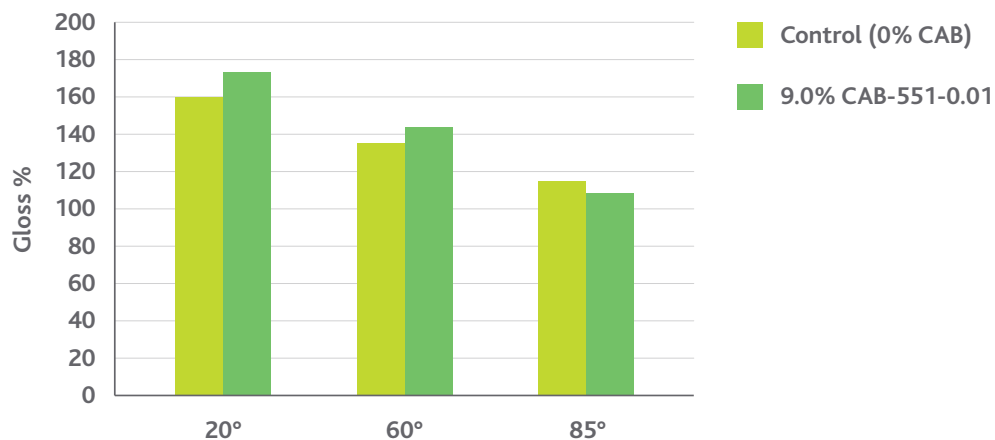
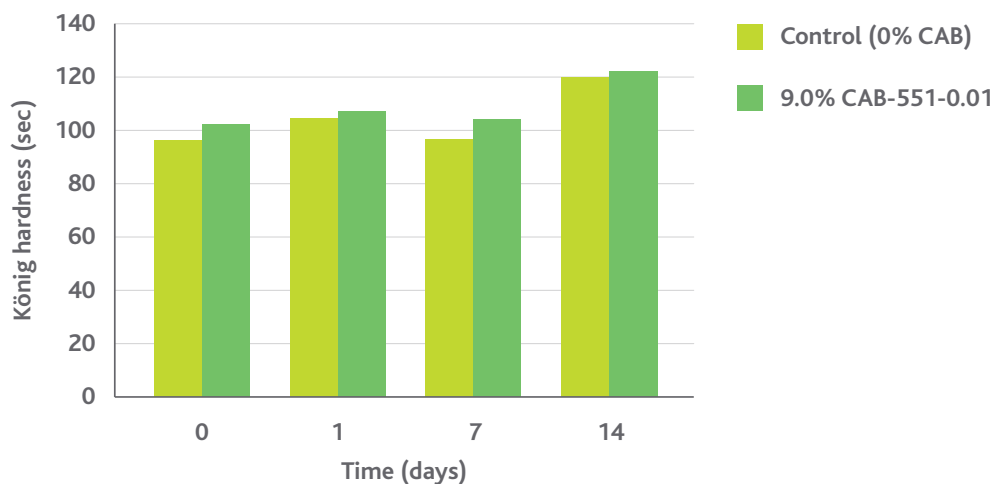


Figure 3. König pendulum hardness development



The results indicated that by adding Eastman CAB-551-0.01 at a level of 9 wt% to the LED-cured nail polish formulation it was possible to significantly decrease the exposure time to acetone required to effectively remove the cured nail polish. Furthermore, the addition of the cellulose ester had not significantly altered the physical characteristics of the cured film in terms of its gloss or hardness development.

Conclusion

By adding a nonreactive cellulose ester resin, Eastman CAB-551-0.01, we were able to demonstrate significantly lower solvent removal time for a commercial LED-cured nail polish composition without compromising the physical properties of the product, such as gloss and hardness development. By minimizing the time necessary to remove the nail polish by exposure to strong solvents, the cellulose ester composition would be expected to offer significantly improved safety characteristics.



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