



Analysis of Water Soluble Polymers in Denture Adhesives by SEC

Application Note

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Introduction

Denture adhesives are complex formulations that contain a number of ingredients. The adhesives are required to provide firm attachment of the prosthesis to the basal seat in the mouth and ideally must provide secure enough a hold to allow the wearer full function. Synthetic materials are by far the most common form of denture adhesive. The most successful of the products currently available include mixtures of carboxymethyl cellulose or CMC with Gantrez, which is a name given to a family of poly(vinyl methyl ether maleate) materials. When the adhesive is applied to the upper surface of the prosthesis and placed in the mouth, the CMC quickly hydrates to form strong ionic interactions with the denture and the palate. During this process, the CMC rapidly increases in viscosity and swells to eliminate voids between the denture and palate, ensuring that a firm hold is maintained. Over a longer time frame than required for the action of the CMC, the Gantrez materials also hydrate and add to the adherence and viscosity. Gantrez also forms cross links that further increase the adhesive properties. It is the action of the 'short-term' CMC and 'long-term' Gantrez materials that give the adhesive the firm hold required. Both polymers are water soluble and so can be analyzed by aqueous size exclusion chromatography.



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Instrumentation

Linear Agilent PL aquagel-OH MIXED 8 μm columns were used, which resolve up to 10,000,000 g mol^{-1} (polyethylene glycol/oxide equivalent). These high performance columns offer excellent resolution over a very wide range of molecular weights, simplifying column selection and providing a versatile analytical system.

The eluent was a buffer employed to reduce ionic interactions during the analysis. However, whereas the CMC could be analyzed at pH 7, the Gantrez material contained anionic groups and had to be assessed at pH 9.

Conditions

Sample: Carboxymethyl cellulose and Gantrez
Columns: 2 x PL aquagel-OH MIXED-H 8 μm ,
300 x 7.5 mm (p/n PL1149-6800)
Eluent: 0.2 M NaNO_3 + 0.01 M NaH_2PO_4
adjust to pH 7 or pH 9 as appropriate
Flow Rate: 1.0 mL/min

Results and Discussion

Figure 1 shows a chromatogram of the CMC material that eluted as a broad polymer but also contained some low molecular weight material.

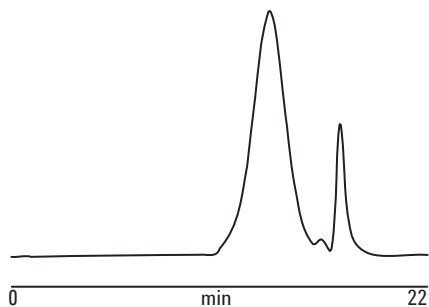


Figure 1. Carboxymethyl cellulose denture adhesive revealed as a mixture of high and low molecular weight polymers

Figure 2 shows the chromatogram of the Gantrez sample that eluted as a bimodal peak, indicating some heterogeneity of the sample as a function of molecular weight.

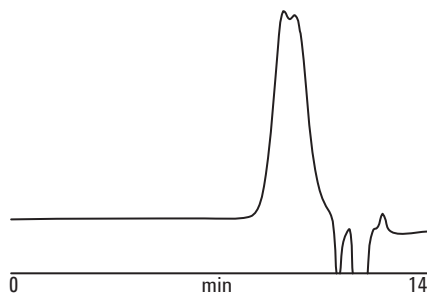


Figure 2. Heterogeneity in a sample of Gantrez dental adhesive

Conclusion

High performance PL aquagel-OH MIXED columns successfully resolved the polymer constituents of a sample of denture adhesive.

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