

Comparative properties of cyanoacrylate monomers with different hydrocarbon chain length intended for surgery practice

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INTRODUCTION: Adhesives intended for bonding of human tissues are generally called bioadhesives. The bioadhesives are easy to apply, reduces the surgical time, avoids the damage produced by suture, inhibit scare formation, and there is no need to remove the remaining sutures or bandages after surgical practice.

Cyanoacrylates polymerizes in the presence of bases, such as water, so they can be applied to skin for surgical practice and wound cloture. However, despite producing effective bonding, the cyanoacrylate adhesives show noticeable exothermic cure and the polymerised product is too stiff, both limiting their effectiveness. One route to reduce the exothermicity and stiffness of the cyanoacrylate adhesives is to increase the length of the hydrocarbon chain in the monomer.

There are scarce literature comparing the performance of cyanoacrylate adhesives with different chain length and most of them are devoted to clinical studies. Dossi et al. [1] studied the anionic polymerization of ethyl, n-butyl and octyl cyanoacrylate in water. They found that both low and high molecular weight polymeric chains coexisted by curing at high temperature. Charters [2] compared three tissue commercial adhesives -*Indermil*®, *Liquiband*® and *Dermabond*®, the best performance corresponded to *Liquiband*® (n-butyl cyanoacrylate).

METHODS: Ethyl cyanoacrylate (ECN) (R=2), butyl cyanoacrylate (BCN) (R=4), and octyl cyanoacrylate (OCN) (R=8) monomers were used.

The liquid monomers were characterized by ATR-IR spectroscopy, ¹H and ¹³C NMR, and thermal gravimetric analysis.

Adhesion was obtained by single lap-shear tests of pig skin/adhesive and aluminium/adhesive joints.

RESULTS: The ATR-IR spectra of the cyanoacrylate monomers show differences in the 950-1200 and 2850-3000 cm⁻¹ regions due to C-O-C, and CH₂ and CH₃ groups, respectively. TGA thermograms show that the increase in the length of hydrocarbon chain increases the thermal stability of the cyanoacrylate (CN) monomer. Whereas ECN shows only one main decomposition at 117 °C, the OCN shows two decompositions at higher temperature (175 and 208 °C) indicating the existence of two structures [1].

Lower adhesion of CN monomer (72 h after joint formation) is obtained by increasing the chain hydrocarbon length (lower stiffness of OCN).

Fig. 1: TGA thermograms of the CN monomers.

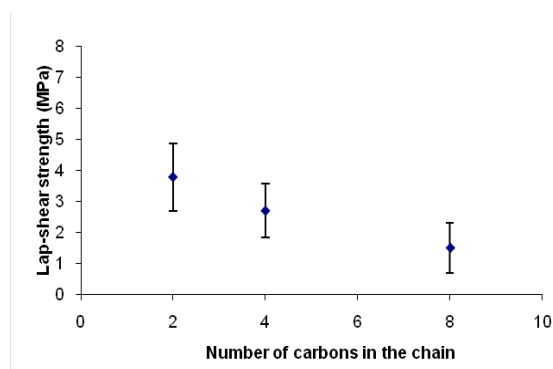


Fig. 2: Single lap-shear strength values of aluminium/CN adhesive joints. 72 h after joint formation.

REFERENCES: ¹M. Dossi, G. Storti, D. Moscatelli (2010) *Macromol. Symp.* **289**:124–8. ² A. Charters (2000) *Accident and Emergency Nursing* **8**:223–7.

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