

Influence of Imidazolium-Based Ionic Liquids on Acrylic Denture Base Materials

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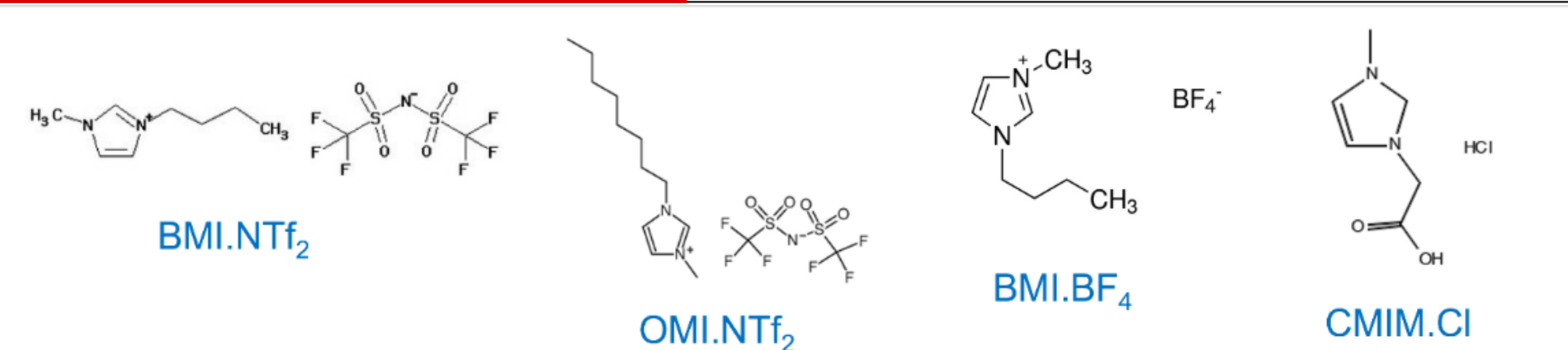
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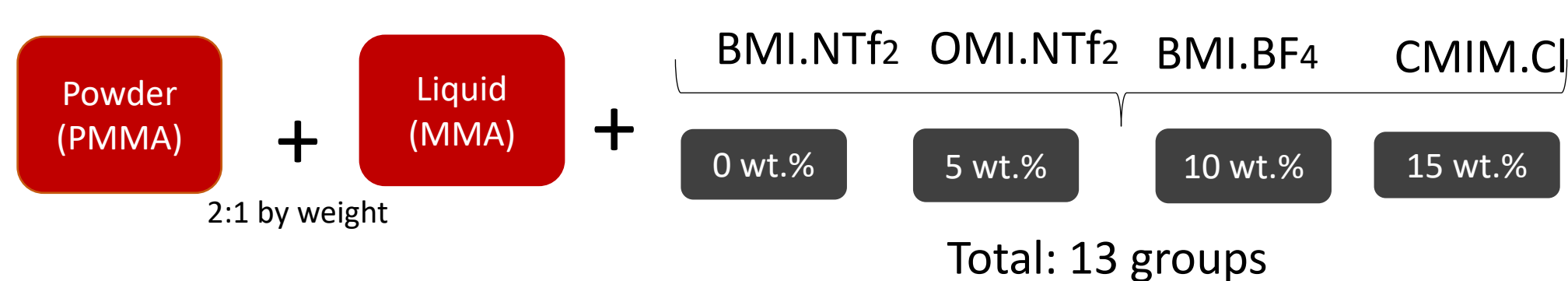
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The aim of this study is to evaluate the effect of four different ionic liquids on the physical properties of heat-activated acrylic resins.

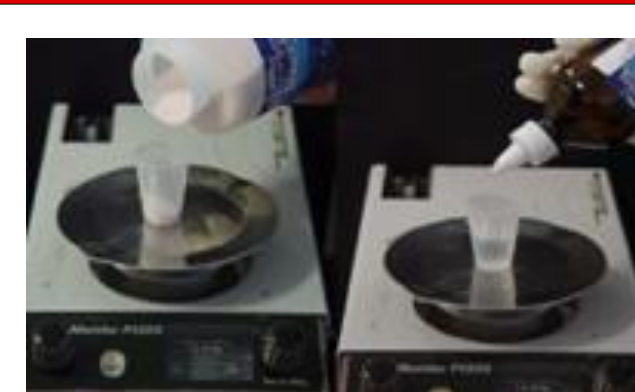
Study Design



Visual depiction of the chemically synthesized imidazolium-based ionic liquids, pivotal in the forthcoming development of innovative 3D printing resins tailored for denture fabrication.



Samples preparation



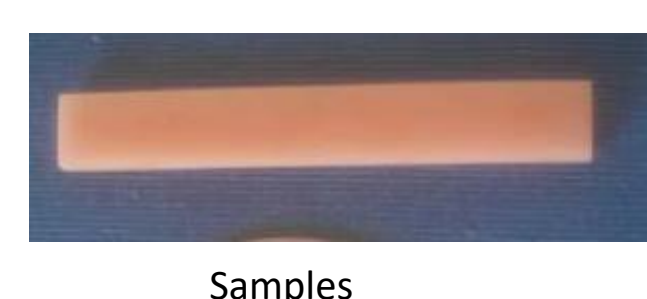
Preparation of resin according to manufacturer's instructions - 2:1 (by mass) + imidazolic salts



Mixing of powder with liquid and plastic phase for embedding in the muffle.



Pressing with 500 kg and opening to remove excesses followed by pressing with 1000 kg.



Samples

After 30 min, start of polymerization in a water bath at 65°C for 8 hours.

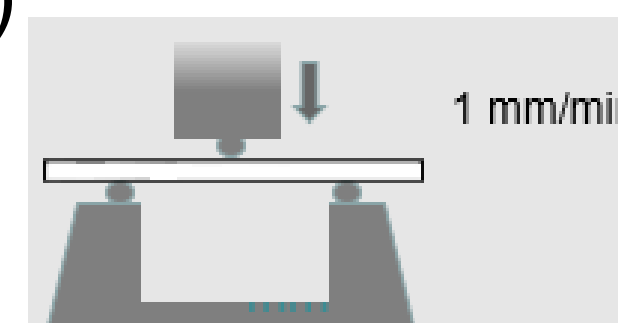
Knoop Hardness

- Microhardness tester 25 g/10 s
- 5 measurements per sample
- Samples: 3 mm thickness
- $n = 5$
- Two-Way ANOVA and Tukey



Flexural Strength

- According to ISO 1567
- Dimensions: 64 x 10 x 3 mm
- Pre-immersion in distilled water (50 hours \pm 2 hours, 37°C)
- $n = 5$
- Two-Way ANOVA and Tukey



Roughness

- Digital roughness tester
- Average of 3 runs
- 0.25 μm each run
- $n = 5$
- Kruskal-Wallis and Dunn



Table 1

Mean and standard deviation of Knoop hardness values for each group without (control group, 0%) or with one of the ionic liquids tested.

	BMI.NTf ₂	OMI.NTf ₂	BMI.BF ₄	CMIM.Cl
0%	19.63 (\pm 0.13) Aa	19.63 (\pm 0.13) Aa	19.63 (\pm 0.13) Aa	19.63 (\pm 0.13) Aa
5%	20.00 (\pm 0.30) Aa	19.91 (\pm 0.46) Aba	17.62 (\pm 1.12) Bb	15.89 (\pm 0.36) Cc
10%	19.98 (\pm 0.89) Aa	19.14 (\pm 0.47) Bb	17.50 (\pm 0.80) Bc	15.97 (\pm 0.71) Cd
15%	19.89 (\pm 0.24) Aa	16.15 (\pm 0.59) Cc	16.18 (\pm 0.36) Cc	17.93 (\pm 0.25) Bb

Values followed by different uppercase letters in the same column indicate statistical difference ($p < 0.05$).
Values followed by different lowercase letters in the same row indicate statistical difference ($p < 0.05$).

Table 2

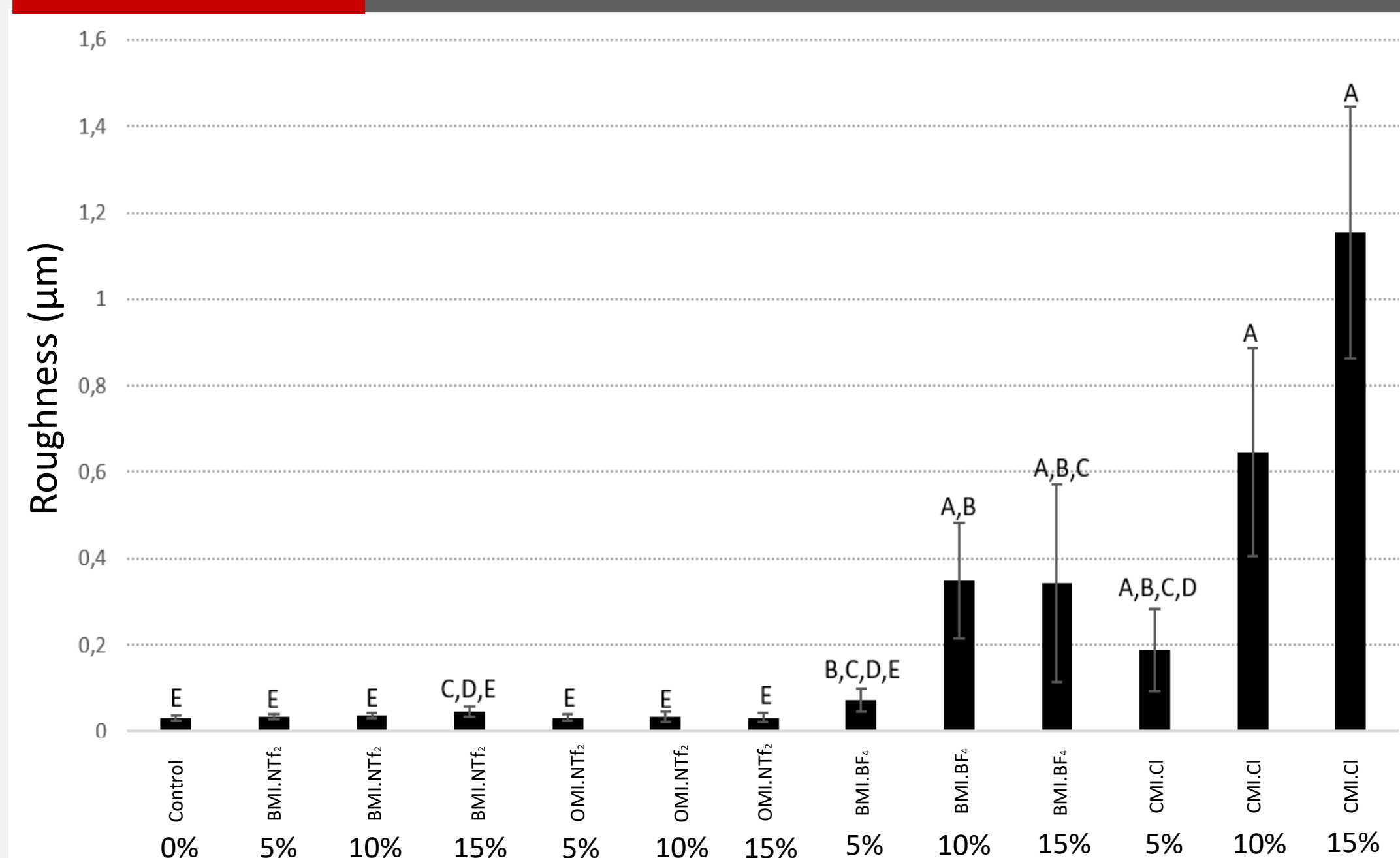
Mean and standard deviation of flexural strength values in megapascals (MPa) for each group without (control group, 0%) or with one of the ionic liquids tested.

	BMI.NTf ₂	OMI.NTf ₂	BMI.BF ₄	CMIM.Cl
0%	75.01 (10.69) Aa	75.01 (10.69) Aa	75.01 (10.69) Aa	75.01 (10.69) Aa
5%	76.88 (13.00) Aa	73.86 (7.11) Aba	50.51 (2.54) Bb	54.67 (2.62) Bb
10%	76.26 (3.56) Aa	71.04 (2.76) Aba	42.60 (2.68) Bb	41.84 (4.58) Cb
15%	71.32 (8.36) Aa	53.01 (3.48) Cb	42.67 (5.18) Bb	42.53 (3.13) Cb

Values followed by different uppercase letters in the same column indicate statistical difference ($p < 0.05$).
Values followed by different lowercase letters in the same row indicate statistical difference ($p < 0.05$).

Figure

Mean and standard deviation values of roughness for each group without (control, 0%) or with the ionic liquids tested.



Different letters indicate statistically significant difference among groups ($p < 0.05$).



The addition of BMI.NTf₂ up to 15 wt.% in acrylic resin did not change the evaluated physical properties of the heat-activated acrylic resin. BMI.NTf₂ should be further tested as a novel anti-fungal agent for acrylic denture base materials.