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Environmental Friendly High Solid Acrylic Copolymers and Applications

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OUTLINE

- ☑ **INTRODUCTION**
- ☑ **PROBLEM and AIM**
- ☑ **EXPERIMENTS and RESULTS**
  - ✓ **Acrylic Copolymer Synthesis**
  - ✓ **Characterisation**
  - ✓ **Application**

INTRODUCTION

- Acrylic copolymer is a polymeric solution containing acrylic monomers and can exist as a solution, solid or dispersion.
- Acrylic copolymers are produced from esters of methacrylic acid, acrylic acid or their derivatives.
- They are used as primers, topcoats, varnishes and coating materials in various industrial applications.
- About thermosetting acrylic copolymer, once cross-linked, they provide films with excellent resistance to organic solvents, moisture and UV light.

INTRODUCTION

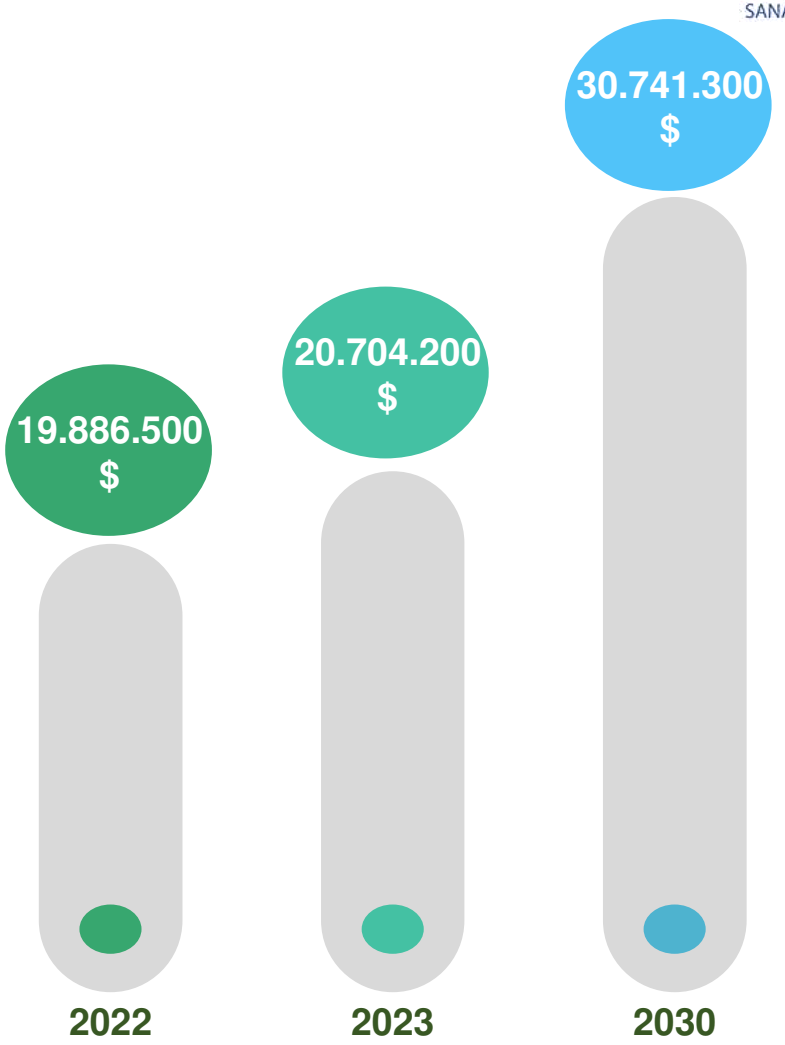
- Marine paint
- Industrial finishing
- Automotive paint
- Outdoor applications
- Road marking

etc

INTRODUCTION

- Considering their consumption, the use of bio-resources instead of petroleum-based components as a substitute or to add new features and increase product performance is of great importance for sustainability studies.

- Annual growth rate for 2023-2030 is approximately 5.6%



https://www.marketresearchfuture.com/reports/acrylic-resins-market

INTRODUCTION

- High solid acrylic resins are a type of polymer widely used in various industrial applications due to their unique properties.

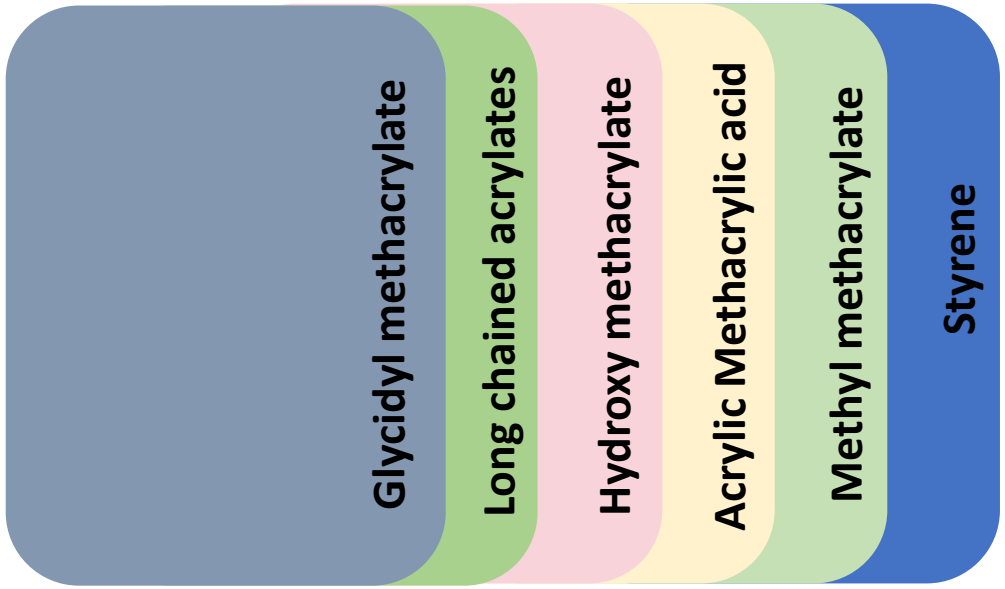
- They are characterized by high solids content and low volatile organic compound (VOC) emissions. Their high solid content means less solvent is required, which provides an advantage by reducing cost and environmental impacts.

- They also offer excellent durability, gloss retention and weather resistance, making them suitable for use in harsh environments.

- Each type of resin has its own characteristics and is suitable for specific applications.

INTRODUCTION

- With the combination of various monomers, acrylic resins can gain many qualities and desired properties. And can be developed for final product demands.



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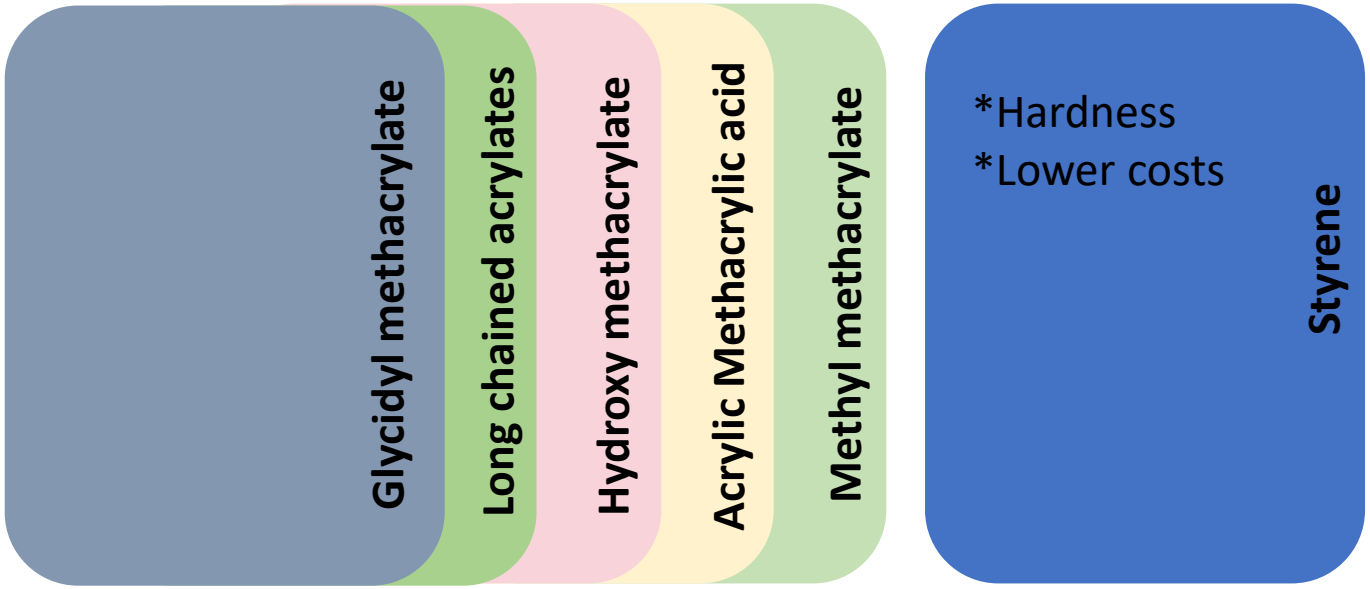

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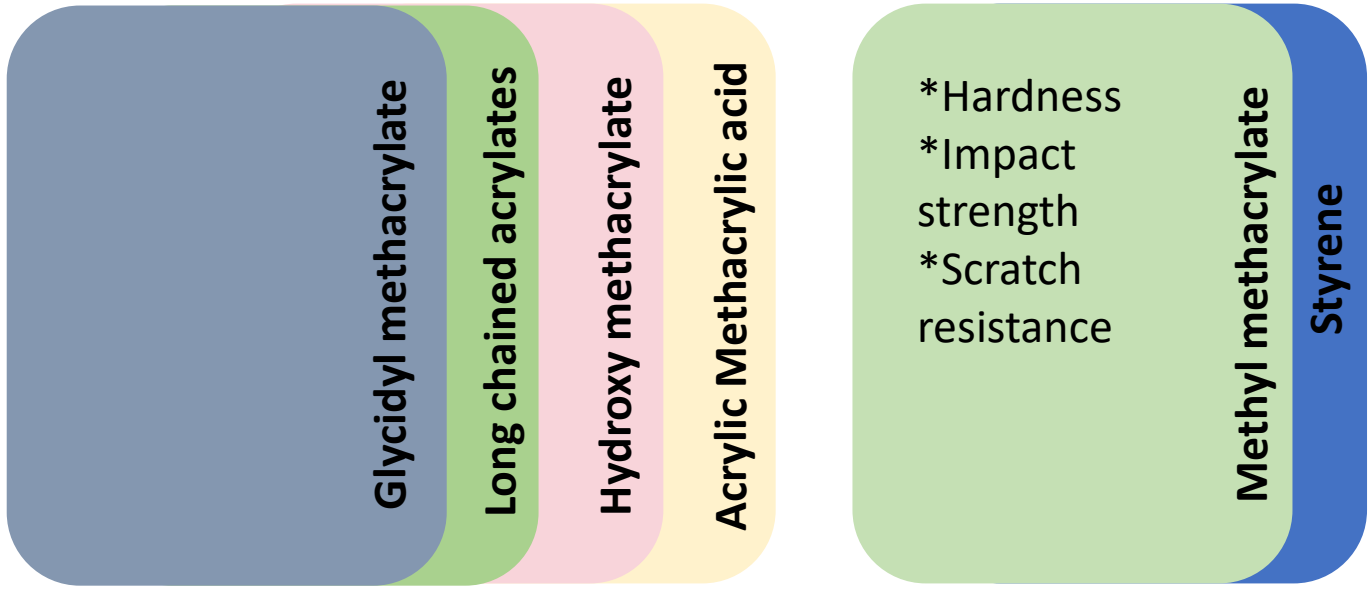

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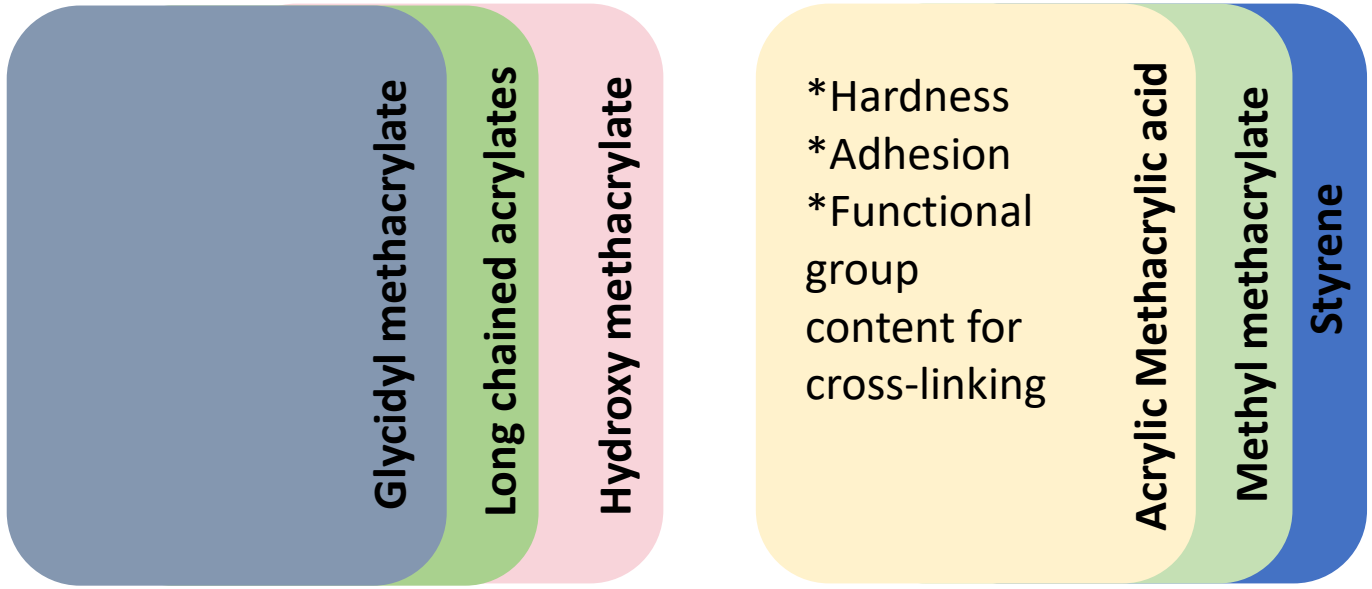

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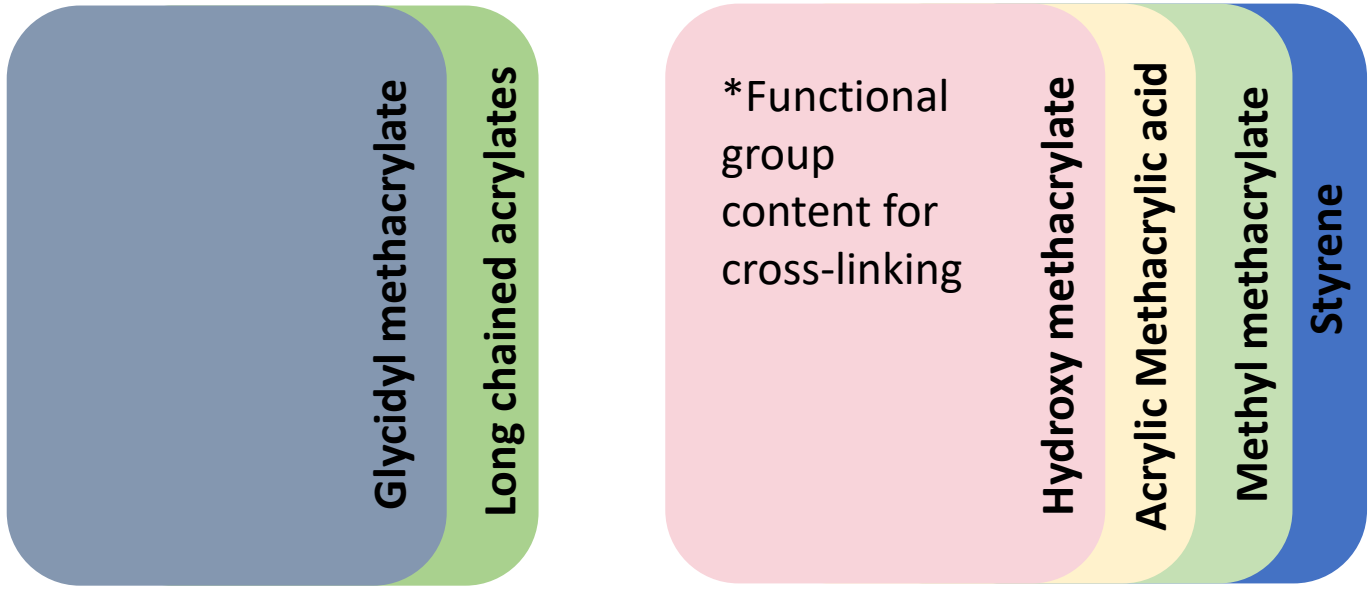

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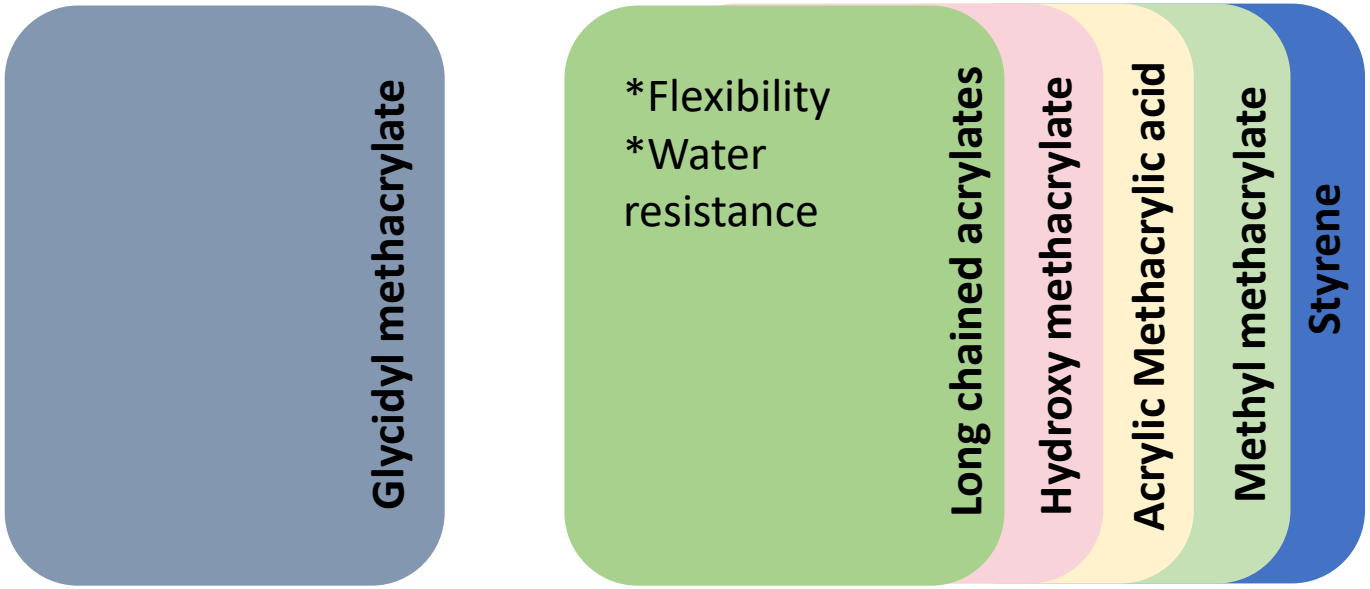

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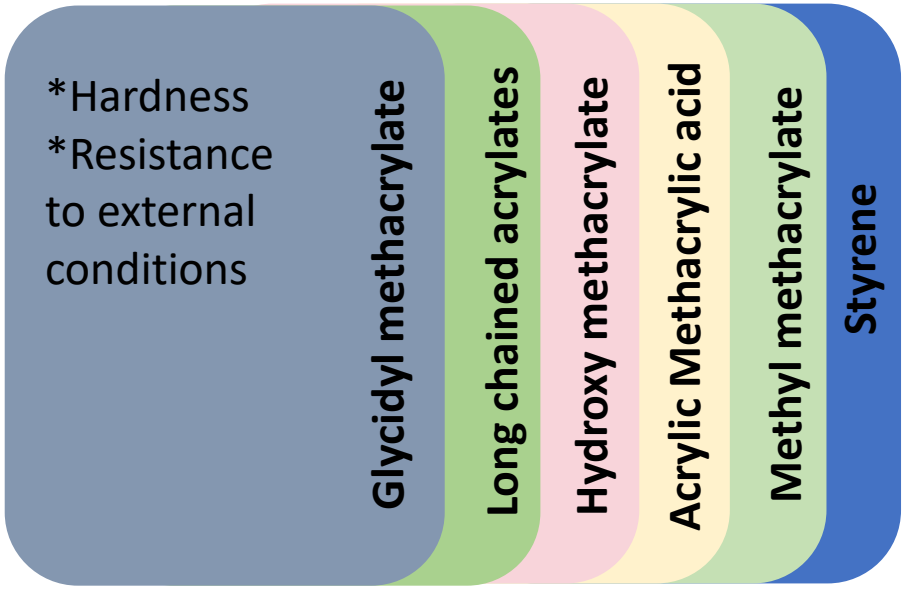
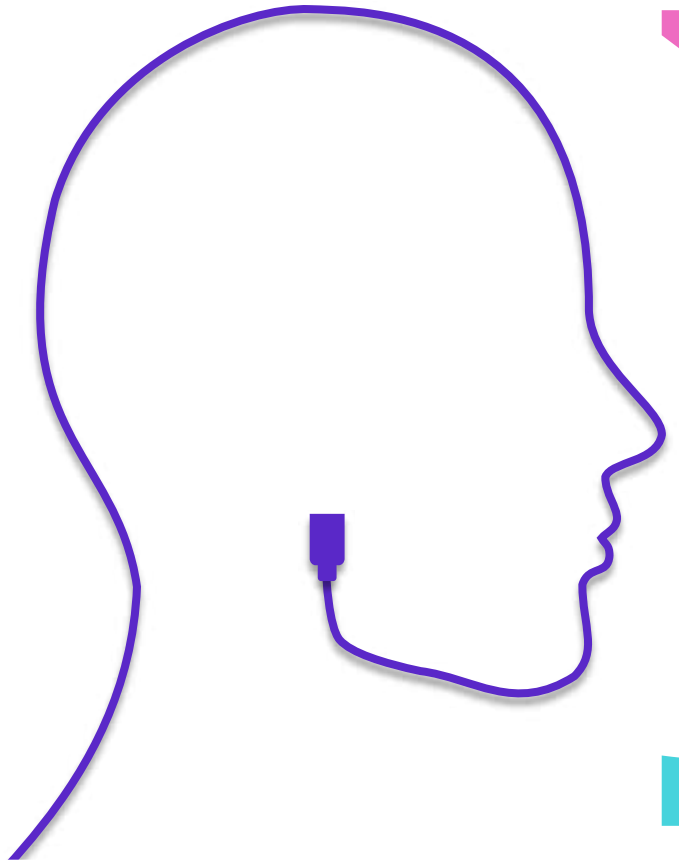


- Reducing volatile organic compound (VOC) emissions is a significant challenge for applications.
- Another emerging trend is the substitution of petrochemical-based materials with low toxic alternatives.
- This issue has gained momentum due to the rising costs of petrochemicals and sustainability concerns.

AIM



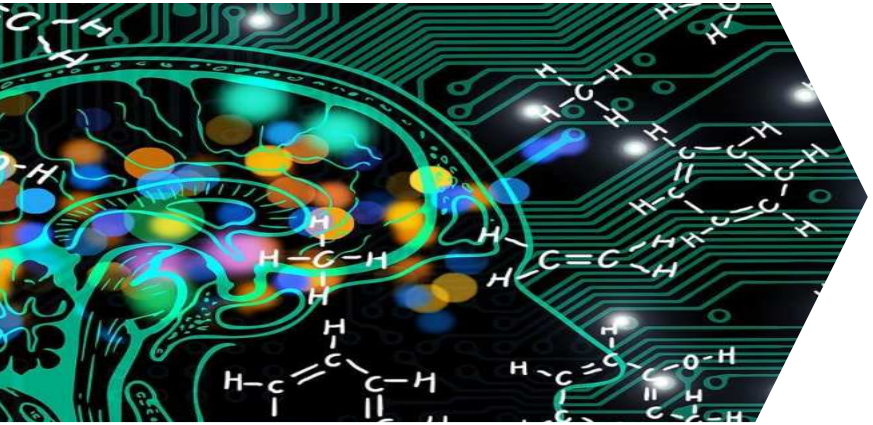
In this study, it was mainly aimed to contribute to the environmental approach.

For this purpose, a two-component acrylic copolymer containing a low amount of solvent (less than 30%) was synthesized.

In addition, an alkyl acrylate monomer was used in the synthesized acrylic copolymer to obtain a more environmentally friendly product.

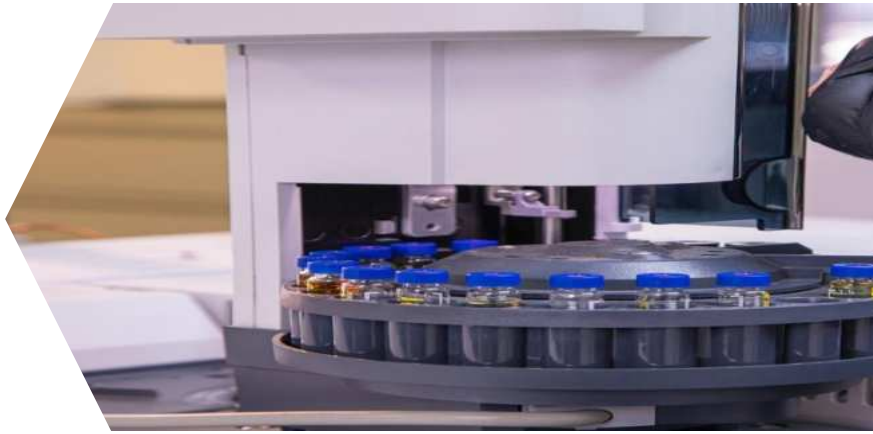
The performance properties of the acrylic copolymer were examined and compared with blank/control copolymer.

EXPERIMENTS and RESULTS



Copolymer Synthesis

Characterisation

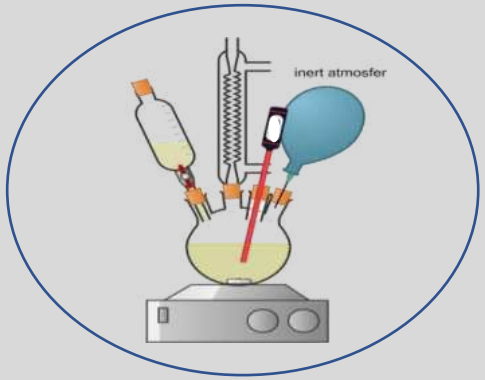


Application

Synthesis

Methyl methacrylate

Butyl acrylate



Acrylic acid

Tert-butyl peroxybenzoate

***Dodecyl methacrylate (20%)**

Dodecyl Methacrylate (DMA) is chemical colorless liquid that possesses excellent adhesive and weather-resistant qualities.

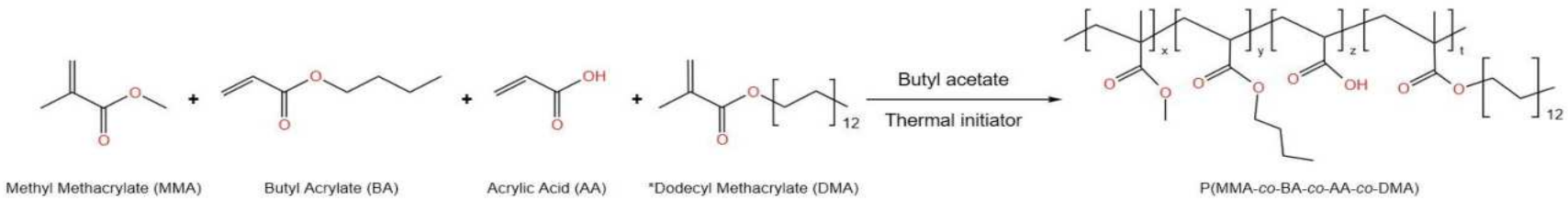
Inks

Paints & Coatings

Adhesives

Personal care products

Others



Characterisation

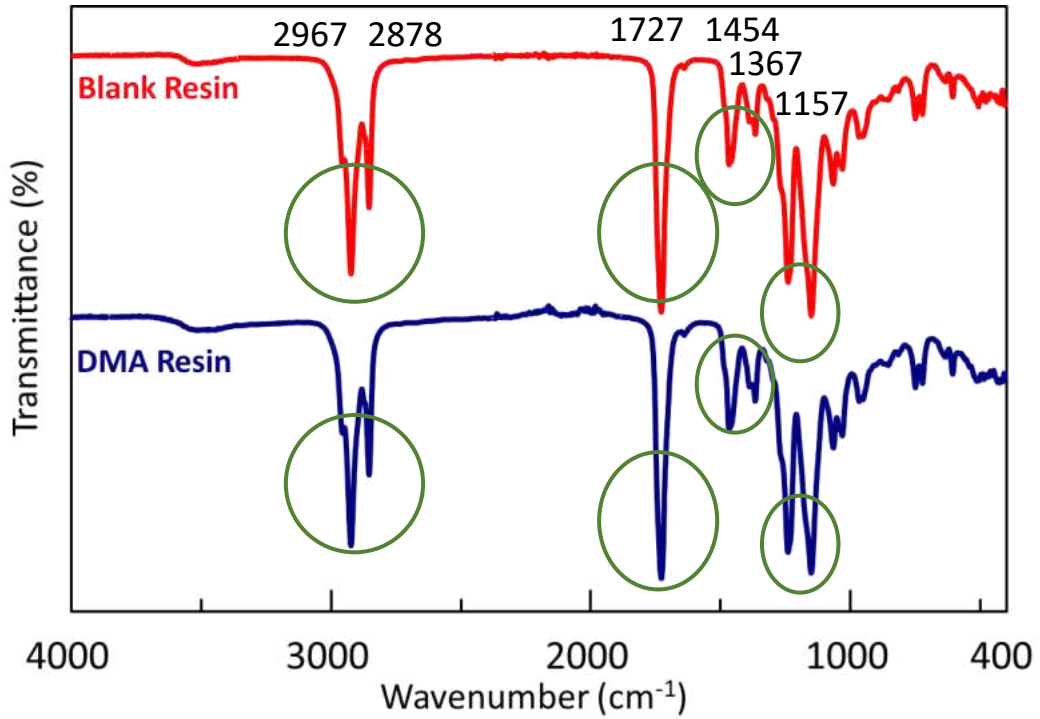


Figure 1. FTIR spectrum of blank and DMA copolymer

- asymmetrical and symmetrical stretching vibration of $–CH_3$
- –C=O stretching vibrations of the acrylate polymer
- $–CH_2–$ and $–CH_3$ deformation vibrations
- O=C–O–C– stretching vibrations of the acrylate polymer

In general, acrylic copolymer was prepared successfully.

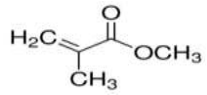
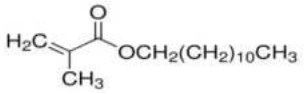
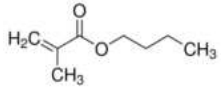
Yong Q, Liang C. Synthesis of an Aqueous Self-Matting Acrylic Resin with Low Gloss and High Transparency via Controlling Surface Morphology. Polymers. 2019; 11(2):322.

Characterisation

Table 1. Analysis results of blank and DMA resin

	Mw (g/mol)	PDI	Solid (%)	Viscosity (s)	Acid (mg KOH/g)
Blank Resin	8.5116e4	1.3580	80	55	7.8
DMA Resin	9.9209e4	1.7084	80	33 ↓	8.2

Table 2. A comperison example of MMA-DMA-BA

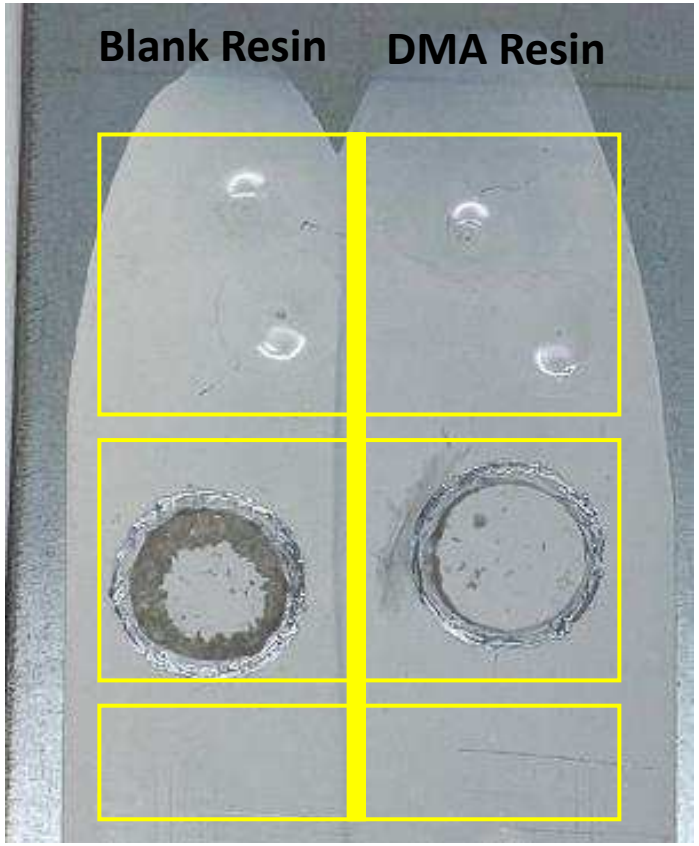
	Tg for homopolymer	Structure
MMA	105 ℃	
DMA	- 55 ℃	
BA	- 50 ℃	

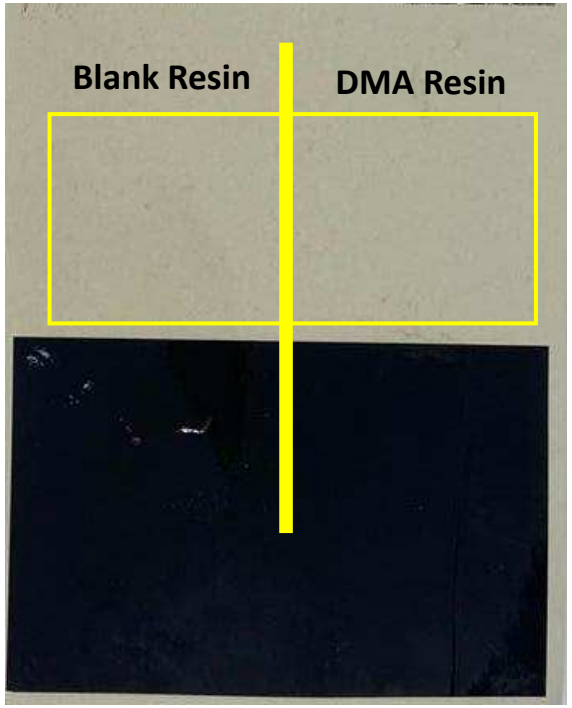
Paint Application

Table 3. Paint application results

TEST	Blank Resin	DMA Resin
Gloss (20 degree)	90	90
Persoz Hardness (2 day, persoz)	57 P	45 P ⬇
Drying (h)	24	24
Impact Strength (Al/Gal/Sheet) *	1/1/1	1/1/1
Cross-cut Adhesion (Al/Gal/Sheet) *	0/0/0	0/0/0
Pull-off (MPa) (Al/Gal/Sheet)	5.1/4.8/4.9	4.9/5.2/4.8
Taber Abrasion Test (1000 rpm) (ΔHz)	0.026	0.023
Yellowing Resistance (Δb)	5	5

*** marked 0 best , 5 worst**

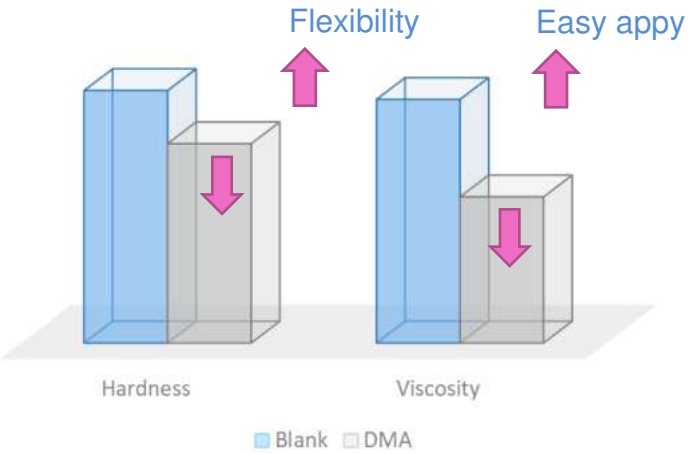




SUMMARY

- An **environmentally friendly** approach was adopted.
- For this purpose, a **low solvent content and low-toxic monomer**-containing polymer was studied.
- The **performance properties** of the environmentally synthesized copolymer were examined.

- It was determined that a more environmentally friendly compound can be used **without loss of important properties** of the copolymer.



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THANK YOU

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