

The Effect Of Addition Of Castor Oil, Grape Seed Oil And Fenugreek Oil On Some Properties Of Cold Cure Acrylic Resin Denture Base Material.

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الخلاصة

الاهداف: تهدف الدراسة الى تقييم تأثير إضافة مستخلصات الزيوت لبعض النباتات (زي الخروع، ..زيت العنب وزيت الحلبة) وبتراكيز مختلفة (1.5، 2.0، 2.5%) على بعض الخواص (التركيب الكيميائي، المونيمر المتبقي، التغير باللون) مثل ميثاكريليك البار. **المواد وطرائق العمل:** تم تحضير عشرة نماذج كوحدة سيطرة، كما تم تحضير ثلاثون نموذج بعد إضافة التراكيز المختارة أعلاه وبمعدل عشرة نماذج لكل تركيز. تم دراسة التركيب الكيميائي للمجاميع المحضرة باستخدام جهاز الأشعة تحت الحمراء، كما تم قياس المونيمر المتبقي باستخدام جهاز الأشعة فوق البنفسجية، اما قوة فتمت باستخدام (جهاز انسيرتن)، تم قياس تغيير اللون باستخدام الظل. **النتائج:** تم تحليل النتائج احصائيا بواسطة برنامج انوفادونكس. **الاستنتاجات:** اثبتت النتائج ان إضافة زيت الخروع بنسبة 2.5% يؤدي الى تقليل نسبة المونيمر المتحرر كما واعطى هذا التركيز تأثير غير معنوي مع قوة وكذلك اللون مقارنة مع وحدة السيطرة.

ABSTRACT

Aims: The aim of the study is to evaluate the effect of addition of some natural and beneficial oils (Castor oil, Grape seed oil and Fenugreek oil) in different concentrations (1.5%,2%,2.5%) on some properties (chemical structure, residual monomer, transverse strength and color change) of cold cured acrylic resin. **Materials & Method:** One hundred samples were prepared from Respal cold cured acrylic resin.Ten samples were the control, thirty samples were prepared with addition of each oil (ten samples for each concentration). Each group of samples were evaluated for chemical structure (by Fourier Transform Infrared Spectrophotometer), residual monomer (by U.V. spectrophotometer), transverse strength (by instron testing machine) and color change by (Vita easy-shade).**Results:** the results were analysed statistically by ANOVA and Duncan's multiple range test. **Conclusion:** it's shown that the Castor oil additive (2.5%) showed decrease in the residual monomer release and not significant difference in transverse strength, lightness, chroma and hue from the standard group.

Key words: Castor oil, Grape seed oil, Fenugreek oil, Cold cure acrylic resin.

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INTRODUCTION

According to review of dental material in dentistry area, the acrylic resins were so well received by the dental profession. There are different type of resins such as heat cure, cold cure, light cure, rapid heat polymerized, high impact resin, reinforcement resin etc⁽¹⁾.

Cold- cured acrylic resin is one of the most frequently used materials in dentistry for repairs, relines, orthodontic appliances, maxillofacial prosthesis in addition to it's use in crown and bridge work as a temporary coverage of prepared tooth^(2,3,4,5).

Chemically activated acrylic resin are

basically the same as the heat cured acrylic resin denture base materials, varying only in the manner in which polymerization is initiated at room temperature⁽⁶⁾. Self-cure resins offered shorter laboratory procedures but the residual monomer caused an increased risk of tissue reactions and decreased fracture resistance⁽⁷⁾.

The main disadvantage of cold curing acrylic is that: unstable color, and more porosity⁽⁸⁾. Strength properties, accuracy, porosity, residual monomer and other properties are field for ongoing research, leading to various modifications to improve its strength

and other properties either by different curing cycle^(6,9), deep freezing⁽¹⁰⁾, and or by using additives materials (glass flake polyethylene fiber, polybutene a reactive plasticizer,herbal extracts)^(11,12,13,14).

The aim of this study is to evaluate the effect of incorporated some extracted natural oils (Grape oil, Castor oil and Fenugreek oil) in different concentrations on some properties (chemical structure, residual monomer, transverse strength and color) on cold cured acrylic resin.

MATERIALS AND METHODS

One hundred samples of cold cured acrylic resin material (Respal) were prepared and divided into :

1. Control(standard) group: 10 samples were prepared without any additive.
2. Experimental group (G): 30 samples were prepared with the addition of Grape seed oil at concentrations of (1.5%,2%,2.5% by weight) ten samples for each concentraion.
3. Experimental group (C): 30 samples were prepared with the addition of Castor oil at concentrations of (1.5%,2%,2.5% by weight) ten samples for each concentration .
4. Experimental group (F): 30 samples were prepared with the addition of Fenugreek oil at concentrations of (1.5%,2%,2.5% by weight) ten samples for each concentration.

The resins were mixed at powder/liquid ratio of (2.5/1) by weight⁽¹⁵⁾. The oil was added gradually (drop by drop) to the polymer with continuous mixing, then the monomer was added gradually to the mixture. When the mixture reached the dough stage, it was packed into the mould that is specified for each test and left under hydraulic press for 15 min⁽¹⁶⁾. After curing the samples were finished and stored in distilled water at 37°C for 48 h for conditioning before testing .

1.Chemical structure:

After 48 hour, the samples (10x4x4) ±0.03 mm⁽¹⁷⁾, one sample for each concentration, were removed from water and dried in air and then scraped using a sharp, clean and sterile wax knife, then 1 – 2 mg of the sample powder was grinded finely, under anhydrous conditions, in an agate mortar. This powder is then thoroughly mixed with 100 – 200 mg of oven – dried, spectral – grade, 100 – 200 mesh potassium bromide powder. The mixture is then pressed into a transparent pellet by using a mini – press.

The KBr pellet is then mounted on a holder and placed in the sample beam of the infrared spectrophotometer⁽¹⁸⁾ .

In the IR charts, two absorbance peaks appeared (the absorbance peak of the C=C from the methacrylate group at 1640 cm⁻¹ and the absorbance peak of the C=O from the ester group at 1720 cm⁻¹).

2. Residual Monomer Measurement Test:

Three Samples with linear dimensions 20x20x3(±0.03) mm⁽¹⁹⁾ were prepared for each concentration. After curing each sample was introduced in sealed glass flask containing 10 ml of distilled water at 37°C. At appropriate times (1st, 2nd, 3rd, 4th, 5th, 6th and 7th days), the supernatants were removed and replaced by 10 ml of fresh distilled water. The time – dependence of the monomer concentration was followed by monitoring the amount of monomer present in the supernatant medium using a CECIL 2000 UV – Visible Spectrophotometer (λ= 254 nm)⁽¹⁹⁾ . A linear calibration curve of methylmethacrylate (MMA) concentration as a function of the absorbance at 254 nm was obtained using MMA standard aqueous solutions in the range 0.025 – 0.5 mg/ml . The results were expressed as a percent of released residual monomer mass with respect to the weight of the specimen⁽¹⁹⁾.

3. Transverse strength Measurement Test:

Three samples with dimensions of 65x10x2.5 (±0.03 mm)⁽²⁰⁾ were prepared for each concentration. After curing, the samples were stored in distilled water at 37 ± 1°C for 48 hour before testing.

The test was applied by using a 3 points bending on an instron testing machine . The device was supplied with a central loading plunger and two supports, with polished cylindrical surfaces of 3.2 mm in diameter and 50 mm between supports. The supports should be parallel to each other and perpendicular to the central line⁽²¹⁾. The tests were carried out with cross head speed of 5mm/min. The test samples held at each end of the two supports, and the loading plunger placed mid way between the supports, the samples were deflected until fracture occurred.

The transverse strength was calculated using the following equation:

$$S = 3PI / 2bd^2 \quad (22)$$

S = transverse strength (N/ mm2)

P= maximum force exerted on specimen (N)

I = distance between supports (mm)

b = width of specimen (mm)

d = depth of specimen (mm).

4. Color change Test:

Acrylic samples were prepared with dimensions of $(20 \times 30 \times 3) \pm 0.03$ mm (23). Three samples were used for each concentration. After curing, the samples were stored in distilled water at $37 \pm 1^\circ\text{C}$ for 7 days before testing.

When the Easyshade device is warming up, the bottom of the screen displays a “presets” selection box. Touching “presets” allows Easyshade’s default mode of operation to be selected and saved. This is achieved by the touch screen of the Easyshade.

The appropriate mode of measurement must be selected, and data reported are mode specific. In the measurements, “tooth single” mode of operation was selected and the device is adjusted to display the results of a measurement as L (Lightness), C (Chroma) and H (Hue).

The device must be calibrated each time when the unit was power – up, but not required between each measurement. Calibration is achieved by placing the 5 mm probe against a calibration block housed within the machine, according to the manufacturer’s instructions.

Samples used for tensile strength procedure will be at dimension of “ $90 \times 10 \times 3 \pm 0.3$ ” mm. according to ADA specification No.12 as seen in Figure (1), and the samples were tested by use of (Gunt universal testing machine) as seen in Figures (2),(3), as specimens were grasped by two arms of machine and pulling force will start at room temperature and result were recorded on computer, forces at failure was recorded in Newton (N) and by formula:

$$\text{Tensile strength} = F M/A (\text{MM})^2 - (9)$$

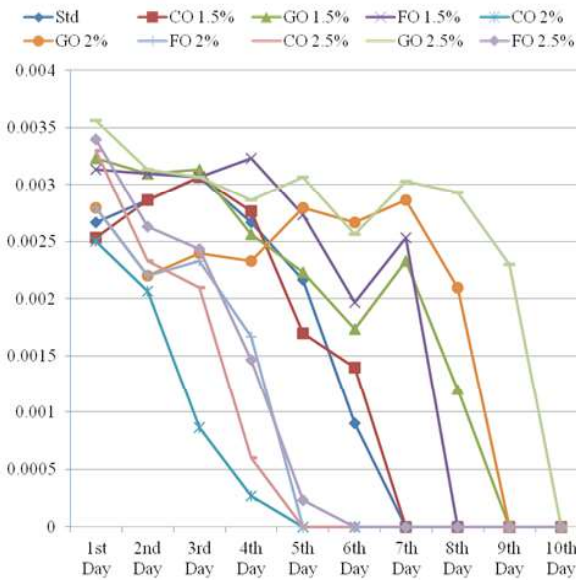


Figure (1) : Residual monomer release of the standard group and the three additive groups

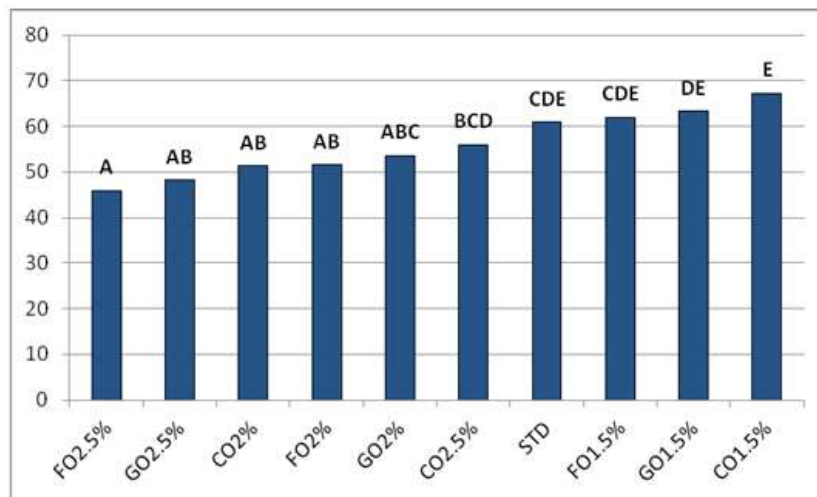


Figure (2) : Duncan's Multiple Range Test For Transverse Strength.

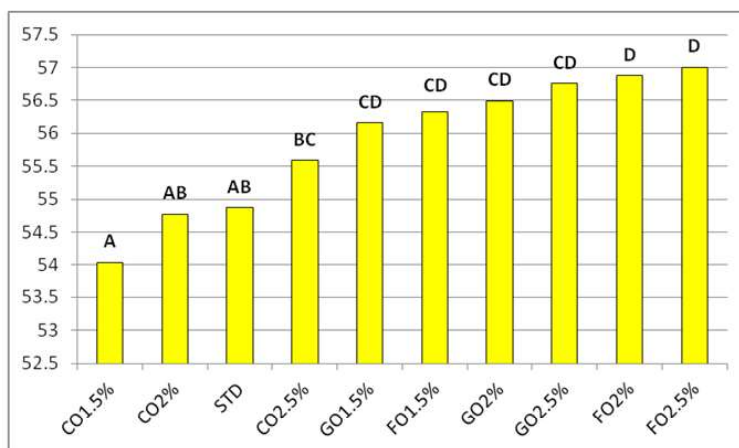


Figure (3) : Duncan's multiple range test for lightness.

Samples used for indentation (Rock Well) hardness test prepared with dimension of (30*15*3±0.03) as shown in Figure (4), random five reading were taken, and the means of this reading were taken The

test was done by using “digital Rock Well hardness” tester Figure (5) and the indenter used inform of round steel ball of 1/4 inch in diameter with a load of 60 kg/MM² and with time up to (15-20) second.

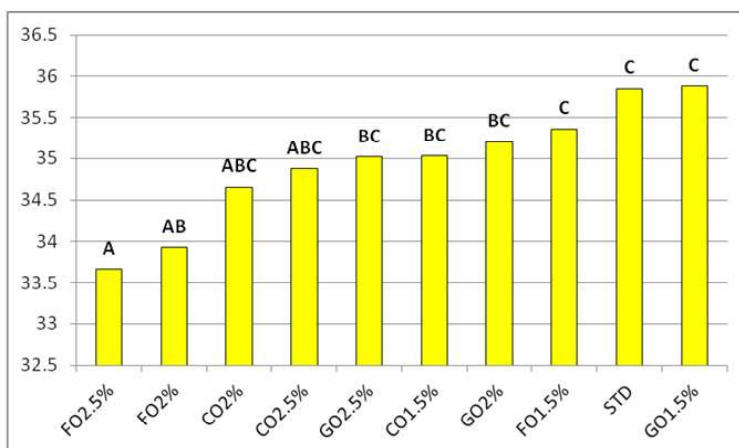


Figure (4) : Duncan's multiple range test for chroma

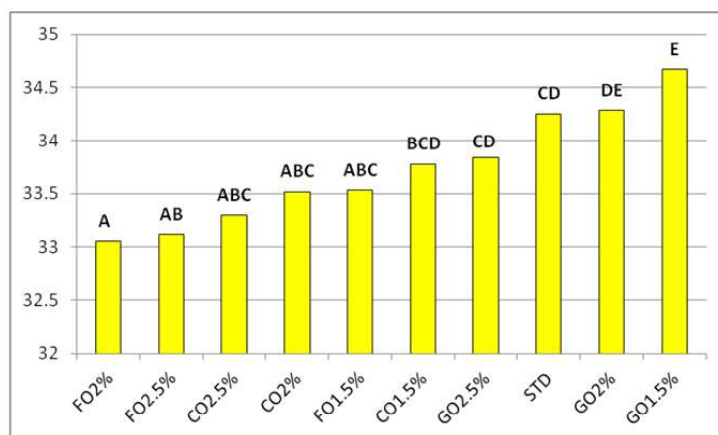


Figure (5) : Duncan's multiple range test for hue.

Statistical test used include one way analysis of vari-ance (ANOVA), Student's (t-test) and Descriptive statis-tics and Duncan's multiple range test for both tensile strength and for indentation hardness test.

RESULTS

1.Chemical Structure

Table (1) : The one way analysis of variance (ANOVA) for transverse strength test of the standard group and the three additive groups

	Sum of squares	Df	Mean square	F	Sig.
Between groups	1343.867	9	149.319	6.170	0.000*
Within groups	484.000	20	24.200		
Total	1827.867	29			

* Significant difference at p<0.05. df: Degree of freedom.

Duncan's multiple range test Figure (2) showed that only Fenugreek oil(2%,2.5%), castor oil(2%), grape seed oil(2.5%) showed significant decrease in transverse strength in comparison with the standard group.

2.Residual Monomer Test
3.Transverse Strength Test

It is shown from Table (1) that there were significant differences in transverse strength between the standard group and the three additive groups with different concentrations.

4.Color Change Test

It is shown from Table (2) that there were significant differences in lightness, chroma and hue between the standard group and the three additive groups with different concentrations.

Table (2) : The one way analysis of variance (ANOVA) for color test of the standard group and the three additive groups.

		Sum of squares	Df	Mean square	F	Sig.
Lightness	Between Groups	28.281	9	3.142	7.646	0.000*
	Within Groups	8.219	20	0.411		
	Total	36.500	29			
Chroma	Between Groups	14.166	9	1.574	3.363	0.011*
	Within Groups	9.360	20	0.468		
	Total	23.526	29			
Hue	Between Groups	7.767	9	0.863	0.292	0.000*
	Within Groups	2.743	20	0.137		
	Total	10.510	29			

* Significant difference at p<0.05. df: Degree of freedom.

Duncan's multiple range test Figure(3) showed that the Castor oil additive(1,5%,2%,2.5%) showed no significant difference, while the Grape seed and Fenugreek oil additive(1,5%,2%,2.5%) showed significant difference in lightness from the standard group.

DISCUSSION

1.Chemical Structure

2.Residual Monomer Test

3.Transverse Strength Test

Flexural (transverse) strength is the measure of stiffness and resistance of a material to it's fracture^(24,25,26). The assessment of flexural strength is used in most of the studies as it's loading characteristics imitate clinical situations in which a denture base undergoes in the oral environment⁽²⁷⁾.

Organic oily additive entered between poly-mer lattice leading to change in its physical configura-tion from irregular form into more regular and straight form this will

lead to sliding of polymer chains onto each other producing a more flexible materials⁽²⁸⁾.

4. Color change test

The color stability of a prosthesis may be the most important factor for determining the patient acceptance^(29,30,31).

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