COMPARISON OF Manihot utilisima (PATI UBI WOOD) TO DIMENSIONAL STABILITYOF IRREVERSIBLE HYDROCOLLOID MOLD (PERBANDINGAN PENAMBAHAN PATI UBI KAYU) (Manihot utilisima) TERHADAP STABILITAS DIMENSI HASIL CETAKAN HIDROKOLOID IRREVERSIBEL)

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Ilmianti[1]*, Muhammad Iqbal[1], Muhammad Hidayatullah[1]
[1]Faculty of Dentistry Universitas Muslim Indonesia Makasar Indonesia
*Corresponding author
hilmianti@gmail.com

ABSTRACT

Alginate impression material is used to print the teeth and the oral tissues; alginate molding material is from abroad and expensive. Modification to the impression material alginate with cassava starch with 1: 1 obtained detailed reproduction of the same printed material alginate without added with cassava starch. The study's objective was to get an alternative form of printed material alginate plus *Manihot utilisima* (cassava starch) with the nature of the physical properties following the standard. The study methods used laboratory experiments. The materials used in this study were printed material alginate (Hydrogum fast setting), starch cassava starch cap dua kelinci, water, and tools calliper inside digital. There were four groups of a control group, a group cassava starch ratio of 50: 50, groups of cassava starch ratio of 60: 40, and a comparison group of cassava starch 70: 30. The results were dimensional stability of printed materials Alginate without additions were (73.72, 48.77, 30.51), the dimensional stability of the printed material alginate with a ratio of 50: 50 were (74.24, 40.82, 30.76), the dimensional stability of the printed material alginate with a ratio of 60: 30 were (75.39, 49.67, 31.57), and the results of dimensional stability alginate ((irrevesible hydrocolloid) molding material with a ratio of 70: 30 were (76.36, 50.94, 32.86). The conclusion is the addition of *Manihot utilisima* on standard printed material alginate (irrevesible hydrocolloid) obtained dimensional stability test results that met the standards at

a ratio of 50: 50 of ANSI/ADA no.18/1992. *Manihot utilisima* was one of the appropriate alternatives as a mixture in impression material alginate (irrevesible hydrocolloid).
Keywords: *alginate, cassava starch, dimensional stability*

ABSTRAK

Bahan cetak alginat (hidrokoloid irrevesibel) merupakan bahan yang digunakan untuk mencetak gigi geligi dan jaringan rongga mulut ,bahan cetak alginat masih di impor dan cukup mahal harganya. Pada penelitian sebelumnya telah dilakukan modifikasi pada bahan cetak alginat dengan pati ubi kayu dengan perbandingan 1:1 dan didapat hasil reproduksi detil yang sama dengan bahan cetak alginat tanpa ditambah dengan pati ubi kayu. Penelitian ini bertujuan untuk memperoleh bahan cetak alginat alternatif berupa bahan cetak alginat (hidrokoloid irrevesibel) yang ditambah pati ubi kayu (Manihot utilisima) dengan sifat sifat fisik yang sesuai dengan standar. Metode dan bahan : Metode penelitian yang digunakan eksperimen laboratorium. Bahan yang digunakan pada penelitian ini adalah bahan cetak alginat (hidrokoloid irrevesibel) hydrogum tipe fast, pati ubi kayu tepung kanji cap dua kelinci, air dan alat caliper inside digital. Terdapat 4 fisik yang sesuai dengan standar. Metode dan bahan : Metode penelitian yang digunakan eksperimen laboratorium. Bahan yang digunakan pada penelitian ini adalah bahan cetak alginat (hidrokoloid irrevesibel) hydrogum tipe fast, pati ubi kayu tepung kanji cap dua kelinci, air dan alat caliper inside digital. Terdapat 4 kelompok yang terdiri atas kelompok kontrol, kelompok perbandingan pati ubi kayu 50 : 50, kelompok perbandingan pati ubi kayu 60 : 40, dan kelompok perbandingan pati ubi kayu 70 : 30. Hasil penelitian : Hasil stabilitas dimensi bahan cetak alginat (hidrokoloid irrevesibel) tanpa penambahan (73.72, 48.77, 30.51), hasil stabilitas dimensi bahan cetak alginat (Hidrokoloid irrevesibel) dengan perbandingan 50 : 50 (74.24, 40.82, 30.76), hasil stabilitas dimensi bahan cetak alginat (hidrokoloid irrevesibel) dengan perbandingan 60 : 30 (75.39, 49.67, 31.57) , dan hasil stabilitas dimensi bahan cetak alginat (Hidrokoloid irrevesibel) dengan perbandingan 70 : 30 (76.36, 50.94, 32.86). Kesimpulan. Penambahan pati ubi kayu (Manihot utilisima) pada bahan cetak alginat (hidrokoloid irrevesibel) standar menunjukkan hasil pengujian stabilitas dimensi yang masih memenuhi standar pada perbandingan 50 : 50 berdasarkan ANSI/ADA

no.18/1992. Pati ubi kayu adalah salah satu alternatif yang tepat sebagai campuran dalam bahan cetak alginat (hidrokoloid irrevesibel).
Kata kunci : alginat; pati ubi kayu; stabilitas

INTRODUCTION

Irreversible hydrocolloid alginate printing material in Indonesia is still a foreign product. This alginate printing material has a broad indication of its use compared to other types of printing materials. Economic factors are often a consideration affecting health care in developing countries. In unfavourable economic conditions, alginate printing materials are quite expensive. It is difficult to obtain alginate printing materials in some areas, so it is necessary to modify the alginate printing materials on the market to overcome this problem. Printing materials cannot be separated from the field of dentistry. With printed materials, we can make a working model and get the shape of the cavity in the mouth like the original. The printout is cast with plaster so that it can be used as study material. For printing, several printing materials can be used, including alginate printing materials.1,2 The main content of cassava starch is carbohydrates, which are polysaccharides.3 Choosing the right combination of alginate and fillers will produce a surface with good quality and detail. According to ANSI/ADA no.18 and ISO 1563/1978, alginate has met the requirements for biocompatibility. When used in the patient's mouth, it is not dangerous when used in the patient's mouth4,5, and cassava starch meets the FAO requirements as an ingredient that humans can consume. In connection with the above statement, it is necessary to research comparing the dimensional stability of the alginate printing material added with cassava starch with various comparisons of starch and alginate powder with standard alginate.

METHOD

The research was conducted on December 28, 2016, and ended on January 4, 2017, at the Laboratory of the Faculty of Dentistry, UMI. This research was a true experimental laboratory method comparing the dimensional stability of the alginate printing material added with *Manihot utilisima.* The data were examined using four groups: the control group without cassava starch, 50 cassava starch groups: 50, the group cassava starch 60: 40, and the group cassava starch 70: 30—WP printing material ratio of 60 g and water 105 ml. The research sample of 24 units and each group 6 units analysed the data using the One Way ANOVA statistical test with a significance level of 0.05. The materials were the fast type of alginate, the Hidrogum brand, and the dua kelinci brand of cassava starch. The test instrument was a dimensional stability test tool that complies with ANSI/ADA no.18/1992 standards, namely Caliper Inside Digital. The dimensional stability of the alginate printing material without cassava starch (control group) was compared with the dimensional stability of the alginate printing material with cassava starch (treatment group).

There were three treatments with the addition of cassava starch, namely the ratios of 50:50, 60:40, and 70:30.

Specimens of standard alginate printing materials and alginate printing materials were mixed with cassava starch in various comparisons, including a rectangular mold made of mica with a print size of 73.48 mm long, 48.69 mm wide, and 30.44 mm high. After setting the time, measurement the length of the specimen with Caliper Inside Digital was looking for the average dimensional stability.

In this study, the material used an irreversible hydrocolloid (alginate) added with *Manihot utilisima*. The result of the mixture was placed into the mold. Dimensional stability was measured using Caliper Inside Digital.

RESULT

The research data shows the comparison of the dimensional stability of the alginate printed material added with cassava with the results as in Table 1 below:

Table 1. The result of the average comparison of dimensional stability of alginate printing materials added by cassava starch

	Length		Wide		Height	
Group	**Mean**	**S.D**	**Mean**	**S.D**	**Mean**	**S.D**
A	73,7267	0,18683	48,7733	0,05750	30,5117	0,04119
B	74,2450	0,07765	48,9700	0,06325	30,7617	0,13977
C	75,3900	0,07720	49,6767	0,32110	31,5783	0,23575
D	76,3650	0,37740	50,9417	0,29397	32,8667	0,41500

Note A (alginate control group without the addition of cassava starch), B (alginate group with the addition of Cassava Starch (50: 50), C (alginate group with the acquisition of Cassava Starch 60: 40), D (alginate group with the addition of Starch Cassava (70: 30). Table 1 shows differences in the value of comparing the dimensional stability of the alginate printing material added with cassava starch between the control group and the experimental group, with mold size of 73.48 mm long, 48.69 mm wide, and 30.44 mm high.

Table 2. Comparison of the dimensional stability of alginate printing material adding cassava starch with the control group

Group	Mean	S.E	P value
Panjang			
Kontrol – B	-0,51833	0,12561	0,003
Kontrol – C	-166,333	0,12561	0,000
Kontrol – D	-263,833	0,12561	0,000
Lebar			
Kontrol – B	-0,19667	0,12807	0,436
Kontrol – C	-0,90333	0,12807	0,000
Kontrol – D	-216,833	0,12807	0,000
Tinggi			
Kontrol – B	-0,25000	0,14406	0,332
Kontrol – C	-106,667	0,14406	0,000
Kontrol – D	-235,500	0,14406	0,000

One Way Anova test, $p < 0.05$ significant

Based on the results of Table 2, the mean value was obtained p value> 0.05, indicated a significant difference in the ratio of dimensional stability between alginate without addition with alginate added with *Manihot utilisima*, and a p value> 0.05 which shows no change in the dimension of stability and $p < 0.05$ there was a significant change in the dimensional stability of the alginate printing material plus the dimensions of the alginate printing material added with *Manihot utilisima.*

Table 3. Comparison of dimensional stability of alginate printing material adding cassava starch with other cassava starch additions group

Group	**Mean**	**S.E**	**P value**
Panjang			
B – C	-114,500	0,12561	0,000
B – D	-212,000	0,12561	0,000
C – D	-0,97500	0,12561	0,000
Lebar			
B – C	-0,70667	0,12807	0,000
B – D	-197,167	0,12807	0,000
C – D	-126,500	0,12807	0,000
Tinggi			
B – C	-0,81667	0,14406	0,000
B – D	-210,500	0,14406	0,000
C – D	-128,833	0,14406	0,000

One Way Anova test, $p < 0.05$ significant

Based on the one-way ANOVA test results, it was found that p-value<0.05, there was a significant change in the stability of the dimensions of the alginate. printing material plus the dimensions of the alginate printing material added by *Manihot utilisima*.

DISCUSSION

The study results from alginate printing material added with cassava starch with the number of groups four, the total ratios of the WP ratio were 60g and water 105 ml. There was a change in dimensional stability due to the synergy process. According to Philips in 2009.[6,7] Syneresis in alginate printing materials in the form of gel experienced water loss due to the evaporation process from the surface of the alginate printing material or the discharge of water from the alginate printing material. In addition, the presence of exudates or foreign objects on the surface of the gel affected the pre-syneresis process. It was different from the theory stated by Craig (2006). [8,9] The change in the dimensions of the alginate printing material was related to the contraction that occurred during the hardening process or the setting time of the alginate printing material. The change in dimensional stability was due to the release of OH from the alginate printing material plus cassava starch. The change also occurred because the alginate printing material plus cassava starch experienced a change in dimensional stability due to the release of water from the alginate printing material. This result was related to the cross-linking that occurs within the polymer chain or between the polymer alginate chains. Apart from contraction, another thing that affected dimensional stability or changes in dimensions was the process of shrinkage caused loss of water components. The alginate printing material expanded due to water absorption and the alginate printing material. The changed the alginate print material became hardened. Another factor affecting the dimensional stability of the alginate printing material was the distortion. This process happened when the alginate printing material did not experience elastic recovery or changes in elasticity; when the alginate printing material hardens, the printing material undercut was removed.[10] Alginate printing materials added with cassava starch get stability test results dimensions that meet ANSI / ADA no.18 / 1992 standards. The dimensional stability of the alginate printing material with added cassava starch has a smaller dimensional stability value than the standard alginate printing material.

Febriani (2001) showed that the modification of the alginate printing material with the ratio of 1: 1 cassava starch obtained the same detailed reproduction results with the alginate printing material without adding cassava starch. There was a difference in dimensional stability between the standard alginate printing material (2.9782 mm and 2.9719 mm) with the common alginate printing material added with cassava starch (2.9797 mm and 2.9795 mm), where the standard alginate printing material was added with starch Cassava had longer dimensional stability than traditional alginate printing materials.[11]

The addition of *Manihot utilisima* to the standard alginate printing material resulted in dimensional stability testing that met ANSI/ADA no.18/1992 standards. The dimensional stability of the alginate printed cloth added with cassava starch has a longer dimensional stability value than the standard alginate printing material.

Cassava starch had a high viscosity, low retrogradation tendency, good sole stability, and low water content. Due to the low water content of cassava starch, it did not affect the dimensional stability of the alginate printing material added with cassava starch. [12]

Phillips (1991), the dimensional stability of alginate printing materials was influenced by syneresis and imbibition events. Syneresis is a condition in which the alginate printing material. When it is in gel form, it will experience water loss due to the evaporation process from the surface of the alginate printing material or the discharge of water from the alginate printing material. The presence of exudates or foreign objects on the surface of the gel affected the pre-syneresis process or the post-syneresis process. When the syneresis and imbisi process occurs, it will change the dimensional stability of the alginate printing material. [9]

After the cross-link bonding process, the alginate molding material formed an irreversible gel network and was no change in shape from gel to sol. The difference in shape from gel to sol meant that after the gel was formed, there were no changes in the dimensional stability of the alginate printing material. Another possibility was the evaporation or syneresis process and an imbibition process of liquid absorption. The result did not affect the addition of cassava starch in the alginate printing material so that the dimensional stability value was almost close.

There were two types of working time, based on ANSI / ADA No.18 / 1992. There were two working times, namely fast set not less than 1.25 minutes and standard set not less than 2 minutes. Setting time, according to ANSI/ ADA No.18 / 1992, the fast set type took 1-2 minutes while the regular set took 4.5 minutes. According to ANSI /

ADA No.18 / 1992, permanent deformation was less than 3% in the undercut area for 30 seconds. Flexibility, according to ANSI / ADA No.18 / 1992, generally 4% - 15% Dimensionalstability, if left for 30 seconds. minutes, the good alginate imprint material did not change. Compressive strength, according to ISO 1563/78, should not be more than 0.30 MPa.7Tear strength, according to ANSI / ADA No. 18/1992, 3,8 - 4,8 N / cm 2. Detailed reproduction, the alginate printing material must be able to record the details properly on the test equipment with a depth of0.07mm.[14] According to Phillips (1991), diatomaceous earth is contained in the material alginate molding functions as a filler or filler, which can increase the alginate's strength or strength in the form of a gel. Without the filler, the gel formation becomes hard, and the alginate molding material becomes sticky. According to Craig (2006), the elasticity or flexibility of alginate printing materials is closely related to silica powder or diatomaceous earth content, which is very useful for controlling the consistency of alginate printing materials. Silica powder theoretically has the chemical formula (OH) 4Si8Al4O20.nH2O when it reacts with water, will occupy an interlamellar space.

Alginate flexibility is strongly influenced by the intercellular structure of the alginate matrix gel. The form of the intercellular gel matrix will be different for different types of algae that produce alginates. If the guluronic acid content is high, it will provide a more flexible texture.[14] Microscopically, there was no change and effect in the structure due to cassava starch adding to the alginate printing material. The elasticity of the alginate printing material was influenced by diatomaceous earth or silica powder composition. [15]

The addition of ***Manihot utilisima*** to the printed alginate packaging material has affected the existence of a significant difference in the compressive strength value. This result was due to differences in the elasticity of the alginate printed form and the alginate printed material added with cassava starch which affected the strength or strength of the material, alginate print. In addition to this, cassava starch to the alginate printing material has involved calcium chloride as a reactor and diatomaceous earth as a filler material. The presence ofcassava starch weakened the strength of the packaging alginate printing material due to inhibition of the activity of calcium chloride as a reactor and diatomaceous earth as a filler material. According to Darvell (2000), the mechanical strength of alginate is strongly influenced by the intercellular structure of the alginate matrix gel. The intercellular form of the alginate matrix gel contains sodium ions, calcium ions, magnesium ions, strontium ions and barium ions. If the sweet potato starch affects the intercellular structure of the alginate gel matrix, it can weaken the alginate molding material; of course, this also weakens the compressive strength and tear strength. Microscopically, there is no visible change in the structure due to cassava starch adding to the alginate printing material, affecting the alginate printing material. Microscopically there was only a physical, not a chemical bond. The result can be seen in the absence of changes in the starch structure's birefringence structure.

CONCLUSION

The study result, it was found that there was a change in the dimensional stability of the irreversible hydrocolloid printing material added with cassava starch. The work was studied using four groups, namely the control group without cassava starch, the group with cassava starch 50: 50, the group with cassava starch 60. : 40, and the group adding cassava starch 70: 30. With a WP ratio of 60 gr printing material and 105 m water, there was a significant change in the dimensional stability of the irreversible hydrocolloid printing material added by cassava starch with alginate printing material without adding cassava starch.

CONFLICT OF INTEREST

As a result, we declare no conflict of interest in the scientific articles we write.

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