RESEARCHERID
THOMSON REUTERS

[Budi* 6(1): January, 2019] ISSN 2349-4506
Impact Factor: 3.799

Global Journal of Engineering Science and Research Management

ADSORBENT TEST OF ZEOLITE STONE AND LENGTH OF HEATING AGAINST SESAME OIL BLEACHING RESULTS

Budi. L. S, Puspitawati. I.R. Zuhri, M.S

* Agriculture Faculty, Merdeka Madiun University, Taman, Madiun, Indonesia
Student of Agriculture Faculty, Merdeka Madiun University,Taman, Madiun, Indonesia

DOI: 10.5281/zenodo.2553457

KEYWORDS: Bleaching, Heating, Oil, Sesame, Zeolite.

ABSTRACT

Sesame (Sesamumindicum L.) is one of vegetable oil sources and it has low levels of saturated fatty acids making it safe for consumption. This study aims to determine the interaction between variety factors, zeolite doses, and heating time on the yield of sesame oil. The research method used is factorial completely randomized design consisting of 3 factors which wasrepeated 3 times. The first factor of variety is V1 (SBR 1); V2 (SBR 2); and V3 (SBR 3), while the second factor is the zeolite dose, Z1 (15%); Z2 (20%); and Z3 (25%), and the thirdfactor is heating time which areT1 (1 hour); T2 (2 hours); and T3 (3 hours). The results showed that there were interactions in the treatment of varieties and doses of zeolite to oil volume with the highest value in combination treatment (V1Z2) was 70.06 ml. Interaction also occurred in the treatment of varieties and heating duration of oil color before heating with the highest value on combination treatment (V1Z3) was 9.83.The oil flavor before heating with the highest value on combination treatment (V3T1) was 3.68. Separately, there are significant effects of variety factors, zeolite doses, and heating time on oil yield.

INTRODUCTION

Sesame (*Sesamumindicum L.*) is one of the sources of vegetable oil known as sesame oil (Budi et al., 2017).In market, demand for sesamecommodityare still very high. According to FAO projection, world consumption of sesame will continue to increase by around 500 tons every year until 2012, while sesame imports will continue to increase by 6-8% every year until 2022. Based on the consumption and import conditions, it can be estimated that the sesamemarket prospectsin the world is relatively good (Anindita, 2007). The prospect of sesame exports depends on the quality of sesame.This is proven by the demands of the importing country that the yield of sesame oil must be more than 40% and the level of pesticide residues is low (Bennett et al., 2006). Sesame is a commodity with high economic value and is needed as a variety of industrial raw materials in countries in the world (Budi & Wardhani, 2017). Sesame commodity has prospective agribusiness and agro-industry opportunities, so that they are feasible to be developed in countries whichhavecomparative advantage of resources and competitive marketing (Budi, 2014).

In Indonesia, sesame production needs to be developed because of the potential of adequate land resources, supportive market prospects and high economic value (Budi et al., 2010). Sesame is one of the agricultural commodities whichis rich in natural nutrients in the form of oil. Oil from sesame seeds can be used as consumption oil, seasoning or salad oil, treating burns, soaps, and skin moisturizers. Sesame oil contains many unsaturated fatty acids which consist of: oleic acid ($C_{18}H_{34}O_2$), linoleic acid ($C_{18}H_{32}O_2$), and linolenic acid. In addition, sesame oil also contains a lot of vitamin E and other functional comparisons whichare good for health (Handajani et al., 2010), (Silalahi et al., 2017). According to Wirawan and Wahyuni (2002), based on the chemical composition of the seed, it is said to be fatty (oily seed) if it has a fat content between 18-50%. Thus, it can be said that sesame seeds include fatty seeds (oily seed) (Sahin & Selin, 2018). Lack of public knowledge in processing sesame seeds makes people only use sesame seeds in addition to making food such as dumplings, bread, etc.

Sesame is unsaturated oil which contains vegetable oil that can be used to reduce cholesterol. One way to get good oil quality is theearth heating with the main composition of SiO^2 and Al^2O^3 occurs due to the presence of Al^{3+} ions on the surface of the adsorbent which adsorb the dye particles (Ketaren, 1996). Oil heating is one of the purification processes which aims to remove particles of natural dyes in oil. Zeolite is a type of natural rock that can be used as an adsorbent in the heating process of oil. Zeolite is very good to be used as an adsorbent because

it has a high absorption, large surface area, has a lot of pores and also the price is relatively cheap and is widely available in Indonesia. Zeolite is a mineral resource that is found in places close to volcanoes such as in West Java (Bayah, Nanggung, Cikalong), in Sumatra (Aceh, North Sumatra, and Lampung) and several other places. From the results of field research, Indonesia has the potential to have zeolite mineral resources, with an estimated 120 million tons of zeolite deposits found in West Java (Husaini, 1990). The use of absorbent (zeolite) and heating time as well astemperature greatly affect the oil bleaching results (Haryono et al., 2012).

This study generally aims to extract oil from sesame seeds to obtain optimal oil yield with Earth Heating zeolite adsorbent in the treatment of various sesame varieties, zeolite doses, and heating time. So, the researchers specifically aim to determine the relationship between sesame varieties, zeolite doses, and heating time on the quality of sesame oil, among others are oil color, oil flavor, pulp content, and oil volume, moisture content, and mass balance

MATERIALS AND METHODS

Sesame plant varieties

Sesame plant varieties can be grouped by age, in which there are long-lived and early-maturing varieties.Based on the color of the seeds, there are white, black, and purplish brown color.Based on the shape of the pod, there are pods with boxes 4,6 and 8. Based on branching, there are branched and unbranched plants(Budi, 2005);(Weeis, 1971);(Beech, 1981);(Abajoglou, 1981).

Zeolites

Zeolites are minerals which are hydrated porous alumina silicate crystals having a three-dimensional skeleton structure formed from tetrahedral [SiO_4] 4- and [AlO_4] 5-. The tetrahedral above is connected by oxygen atoms, producing an open and hollow three-dimensional structure which is filled with metal atoms usually alkaline or alkaline earth metals and free-moving water molecules (Breck, 1974);(Chetam, 1992);(Scott et al., 2003). The structure of zeolite is an inorganic polymer in the form of a tetrahedral unit TO4, where T is the Si4 + or Al3 + ion with the O atom between the two T atoms.

Materials and tools used in the studyshown in Table 1.

Table 1.Materials and tools used in the study

Research Materials	*Research Tools*
Sesame seeds varieties SBR1, SBR 2, SBR 3, 3.5% HCl solution, Oil bottle, Jars, Label, Zeolite , Aluminum foil paper, Tissue, Wash foam, Bottle of culture and Filter cloth Plastic	funnel Digital, Stopwatch, Oven, Brush / solet, Measuring cup, Hydraulic press, Blender scales

RESEARCH METHODS

The research method used was Factorial Design Experiment based on Completely Randomized Design (CRD) consisting of 3 (three) factors which arerepeated 3 (three) times. RAL was chosen because the research was conducted at the Laboratory of the Faculty of Agriculture, Merdeka University, Madiun. The purpose of the factorial experiment is to see the interaction between the factors used. The first factor consists of: V1: SBR 1 variety, V2: SBR 2 variety and V3: SBR 3 variety . The second factor consists of: Z1: Zeolite 15%, Z2: Zeolite 20%, and Z3: Zeolite 25%. The third factor consists of: T1: 1 hours, T2: 2 hours, and T3: 3 hours

Data Observation and Analysis Techniques

Observations were made on 3 samples of each treatment. The parameters observed are as follows: 1) Oil Volume, 2) Oil color, 3) Oil Flavor, 4) Taste of oil, and 5) Bivariate Correlation.

RESULTS AND DISCUSSION

Oil Volume

The results of statistical analysis showed that interaction occurred in the sesame variety (V) factor with a dose of zeolite (Z) to the volume of oil. The average value of interaction between factor varieties with zeolite doses is presented in Figure 1.

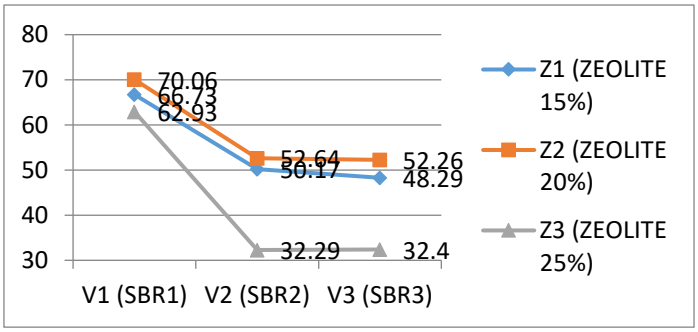

Fig 1. The interaction curve of sesame variety (V) with the dose of zeolite (Z) to oil volume

Oil Color

The results of statistical analysis showed that the interaction occurred in the sesame variety (V) factor with the bleaching time (T) of the oil color before heating. The average value of the interaction between factors with long heating time is presented in Figure 2.

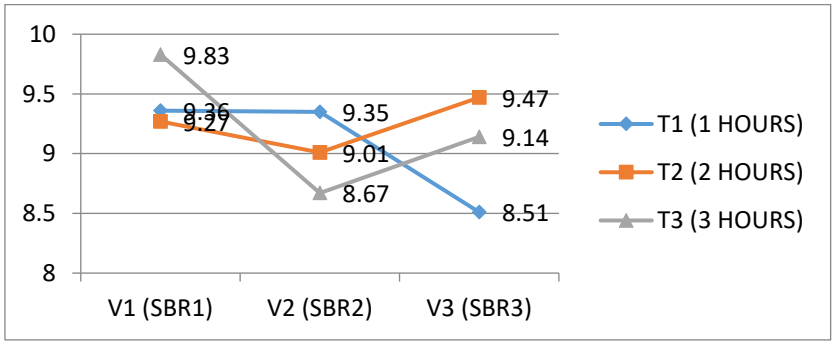

Fig. 2. The interaction curve of sesame variety (V) with heating time (T).

The results of statistical analysis showed that there was no interaction between the factors of sesame variety, zeolite dose, and heating time on the oil color after heating. The average oil color value after heating on the sesame variety factor, zeolite dose, heating time is presented in Table 2.

Table 2 Average value of oil color after bleaching on sesame variety factors, zeolite doses, and heating time.

Factor	Average value	Factor	Average value	Factor	Average value
Varieties		Zeolite Dose		Heating time	
V_1	10.24a	Z_1	10.03a	T_1	9.64a
V_2	9.83a	Z_2	9.88a	T_2	10.20a
V_3	9.84a	Z_3	10,00a	T_3	10.18a

Note: The numbers followed by the same letter are not significantly different from the Duncan test level of 5%.

Oil Flavor

The results of the statistical analysis showed that aninteraction occurred in the sesame variety (V) factor with the duration of heating (T) to the flavor of the oil before bleaching. The average value of interaction between sesame variety factors with long heating time is presented in Figure 3.

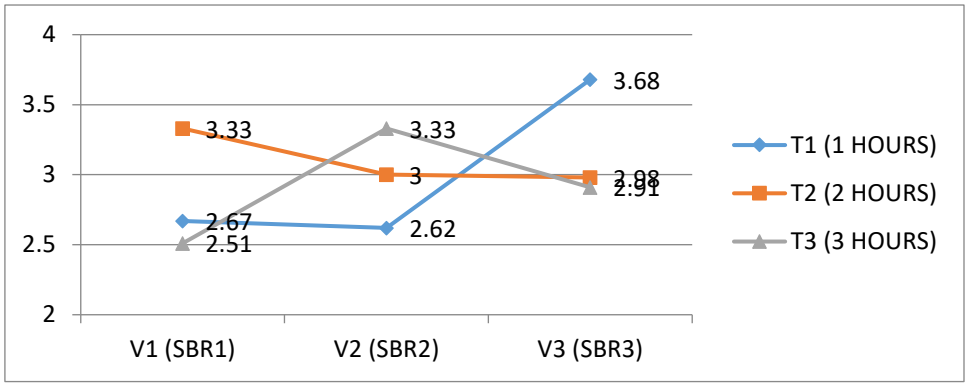

Fig. 3. The interaction curve of sesame variety (V) with heating time (T).

The results of the statistical analysis showed that there was no interaction between the factors of sesame variety, zeolite dose, duration of heating on the flavor of oil after bleaching. The average value of oil flavor after bleaching on sesame variety factors, zeolite doses, heating time ispresented in Table 3.

Table.3 Average value of oil flavor after bleaching on sesame variety factors, zeolite dose, and heating time

Factor	Average value	Factor	Average value	Factor	Average value
Varieties		Zeolite Dose		Heating time	
V_1	3.46a	Z_1	3.47a	T_1	3.59a
V_2	3.47a	Z_2	3.47a	T_2	3.53ab
V_3	3.57a	Z_3	3.56a	T_3	3.37a

Note: The numbers followed by the same letter are not significantly different from the Duncan test level of 5%.

Oil Taste

The results of the statistical analysis showed that aninteraction occurred in the sesame variety (V) factor with the duration of heating (T) on the oil taste before bleaching. The average value of interaction between the factors of the variety with the duration of heating is presented in Table 4.

Based on Table 4, itshows that treatment of V1T1 (7.33), V2T1 (7.44) were not significantly different, while V3T2 (7.74), V2T2 (8.19), V3T3 (8.22), V1T2 (8, 67) not significantly different. The highest average oil flavor before bleaching isin the Sumberrejo 3 (V3) sesame variety combination with 1 hour heating time (T1) which is9.82, while the lowest average oil flavor before the bleaching is in Sumberrejo 1 (V1) sesame variety combination with a long heating dose for 3 hours (T3) which is 7.04.The results of statistical analysis showed that there was no interaction between sesame variety factors, zeolite doses, bleaching time to oil taste after bleaching.

Table 4. Average value of oil taste before bleaching interaction of sesame variety factors with heating time.

Varieties x heating time	Average value (ml)
V_1T_1	7.33ab
V_1T_2	8.67abc
V_1T_3	7.04a
V_2T_1	7.44ab
V_2T_2	8.19abc
V_2T_3	9.22bc
V_3T_1	9.82c
V_3T_2	7.74abc
V_3T_3	8.22abc

Note: The numbers followed by the same letter are not significantly different from the Duncan test level of 5%.

Bivariate Correlation

The results of the correlation analysis showed that there was a relationship between oil volume, color, flavor, and taste. The correlation values between oil volume, color, flavor and taste are presented in Table 5.

Table 5.Correlation values of Volume of Oil, Colour, flavor, Taste

	Oil Volume	Colour	Flavor	Taste
Oil Volume	1	0.243*	-0.165	-0.172
Sig. (2 – Tailed)		0.029	0.141	0.126
Colour	0.243*	1	-0.127	-0.123
Sig. (2 – Tailed)	0.029		0.258	0.273
Flafor	-0.165	-0.127	1	0.933**
Sig. (2 – Tailed)	0.141	0.258		0.000
Taste	-0,172	-0.123	0.933**	1
Sig. (2 – Tailed)	0126	0.273	0.000	

*Note: ** Correlation is significant at the 0.001 level (2-tailed)*
** Correlation is significant at the 0.001 level (2-tailed)*

Based on Table 5, it shows that there is a very strong relationship between the flavorand thetaste and there is a weak relationship between oil volume and color. There is a significant difference ofthe relationship between the oil volume and the oil color whichis 0.243, while the relationship value of the oil flavor and oil taste is 0.933. The direction of the relationship is directly proportional to the relationship between the oil volume and color, and the relationship between flavor and taste. This means that if the oil volume is more and more, the color of the oil becomes clearer and if the flavor of the oil becomes more delicious, the taste of the oil will be even better. Meanwhile, the direction of the relationship is inversely proportional that is the relationship between the oil volume and flavor, the volume andtaste, the color andtaste. It means that if the oil volume is more and more, the oil flavor becomes less pleasant, whileif the oil volume is less, then the oilflavoris more delicious. If the oil color becomes clearer then the oil taste gets worse.Meanwhile,if the oil color gets darker, the oil taste gets better. Thefactor of heating time at a temperature of 100-1100C greatly affects the results of the organoleptic tests on oil (Morad et al., 2006); (Gibon et al., 2009); (Hasibuan& Malayu, 2016).

CONCLUSION

The results showed that varieties, zeolite doses, and length of time had the same effect on water content, color, taste and aroma or flavor, and varieties factors. As if using the right zeolite is 15% giving the best oil yield with a duration of 2 hours at temperature 115^{o}C.

ACKNOWLEDGEMENTS

Thank you very much to: (1) The Director General of Research and Community Service DirectorGeneral of the Higher Education Ministry for Research Technology and Higher Education of the Republic of Indonesia. (2) The coordinator Region VII Surabaya, (3). The Rector of MerdekaMadiun University (4). The Chairman of the Institute for Research and Community ServicesMerdekaMadiun Universitywho have given full trust and responsibility in conducting research, in order to achieve academic forum on higher education.

REFERENCES

1. Abajoglou, K. (1981). Sesame breeding at the Cotton Research Institute in Greece. In Sesame Status and Improvement. Rome Italy: Proc.Exspert consultation.
2. Anindita, R. (2007). Posisi wijen indonesia dalam perdagangan wijen dunia (7th ed). Malang, Indonesia: Ballitas malang.
3. Beech, D.F. (1981). Sesame: Sesame agronomic approach to yield improvement. In Sesame Status and Improvement. Proc.Expert Consultation.
4. Bennett, M., Annebo, S.M.N., Azevedo, C. (2006). Inositol pyrophosphates: metabolism and signaling. Cellular and Molecular Life Sciences, 52-64.
5. Breck, D. W. (1974). Zeolite Molecular Sieves: Structure, Chemistry, and Use. New York, NY: John Wiley and Sons.
6. Budi. L. S. (2005). Penampilan Sifat Agronomis Plasma Nutfah Tanaman Wijen (Sesamum Indicum L) Jenis Lokal. Agritek, 7-12.
7. Budi. L. S. (2014). Strategy and structuring Development System Sesame Agroindustrial in Indonesia. International Journal on advenced science engineering and Information Technology, 4(1),30-33.
8. Budi, L. S., &Wardhani, R.M. (2017). The Application of Fuzzy Logic Control Systems on Harvesting Standard Operating Procedures Models of Sesame Crops in Indonesia. Journal of International Journal advanced science Engineering Information Technology, 1089-1098.
9. Budi, L. S., Ma'arif, M.S., Saillah, I., Raharja, S. (2010). The Strategy For Selecting Institutional Model And Financial Analysis Of Sesame Agroindustry. Journal of Agroindustrial Technology,19(2), 56-63.
10. Chetam, D. A. (1992). Solid State Compound. Oxford, UK: Oxford University Press.
11. Gibon, V., Ayala, J. V. P., Dijckmans, Maes, J., Greyt, W. D. (2009). Future prospects for palm oil refining and modifications. OCL,16, 193-200.
12. Haag, W. O., Lago, R. M., Weisz, P. B., (1984). The active site of acidic aluminosilicate catalysts, Nature, 309, 589-591
13. Handajani., Sri., Manuhara, B. H. K., Anandito. (2010). Pengaruh Suhu Ekstraksi Terhadap Karakteristik Fisik, Kimia, dan Sensoris Minyak Wijen (Sesamum Indicum L.).Agritech, 30 (2), 116-122.
14. Haryono, Ali, M., Wahyuni. (2012). Pemucatan Minyak Sawit Mentah Menggunakan Arang Aktif. Teknik kimia, 6(2): 41-45.
15. Hasibuan, Malayu S. P. (2016). Manajemen Sumber Daya Manusia (Edisi Revisi). Jakarta, Indonesia: PT Bumi Aksara.
16. Husaini. (1990). Percontohan Pengolahan Zeolit Bayah. Bandung, Indonesia: PPTM.
17. Ketaren, S. (1996). Pengantar Teknologi Minyak dan Lemak Pangan. Jakarta, Indonesia: Universitas Indonesia Press.
18. Morad, N. A., Aziz, M. K. A., Rogani, M. Z. (2006). Processing design in degumming and bleaching of palm oil. Center of Lipids Engineering and Applied Research.Johor, Malaysia: University Technology.
19. Sahin, Selin. (2018). Assessment Of Sesame (Sesamum indicum.L) cake as a source of high-added value substances: From waste to health. Phytochemistry Rev, 1-11.doi.org/10.1007/s11101-018-9554-4
20. Scott, M. A., Kathleen A. C., Prabir D. K. (2003). Handbook of Zeolite Science and Technology.New York, USA: Marcel Dekker
21. Silalahi, Rahmadhan. R.L., Sari, D. P., Dewi I. A.,(2017). Pengujian Free Fatyi Acid (FFA) dan Colour untuk Mengendalikan Mutu Minyak Goreng Produksi PT XYZ.Jurnal Teknologi dan Manajemen Agroindustri, 6(1): 41-50.
22. Weeis, A. A. (1971). Castor, Sesame, and Safflower. London, UK: Leonard Hill.
23. Widi, A., Amin A., Aprimal. (2006). Pemucatan Minyak Kelapa Sawit (CPO) dengan Cara Adsorben Menggunakan Zeolit Alam Lampung. Proceedings Seminar Nasional dan Temu Bisnis Zeolit V. ISBN (979-15213-0-1).