



## RESEARCH ARTICLE

### PLASTIC MIGRATION IN DRINKING WATER WITH A TEMPERATURE OF 80°C BY THE TYPE OF POLYPROPYLENE PLASTIC CUPS

\*Nany Djuhriah, Fany Perwirawati and Teguh Budi, P.

Department of Environmental Health, Health Polytechnic Bandung, Babakan Loa 10A Cimahi Utara, Kota Cimahi

#### ARTICLE INFO

##### Article History:

Received 27<sup>th</sup> June, 2016  
Received in revised form  
08<sup>th</sup> July, 2016  
Accepted 20<sup>th</sup> August, 2016  
Published online 30<sup>th</sup> September, 2016

##### Key words:

Packaging,  
Plastics Migration,  
Water.

#### ABSTRACT

Food packaging is the material used to contain or wrap food, either in direct contact with food or not. Polypropylene plastic widely used as a cup for beverage containers, Polypropylene use often do not pay attention to the health hazards, dangers, Polypropylene plastic use at temperatures of 80°C to cause migration of plastic. Several factors can affect the migration of plastic is food or drink temperature, contact time and surface area. This study is experimental. Purposive sampling technique that the sample is determined by the researchers themselves using drinking water with a temperature of 80°C with a type of plastic Polypropylene. The aim of research to determine the effect of contact time on the activities of the plastic migration in drinking water at a temperature of 80°C. The results showed there were two chemical compounds are styrene and pthalic acid. The results of the examination of samples of 18 samples of the activity of the compound styrene on contact time of 20 minutes amounted to 67.856%, 30 minutes 72.403%, 40 minutes 74.881% while the activity of compounds pthalic acid on contact time of 20 minutes 32.144%, 30 minutes 27.596%, 40 minutes 25.119%. Suggestion research that people use plastic type in accordance with the designation, especially regarding temperature and use a plastic that has the label of food grade as well as for further research are expected to continue to compound concentration and compatibility between types of plastics by type of compound migration results.

Copyright © 2016, Nany Djuhriah et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Nany Djuhriah, Fany Perwirawati and Teguh Budi, P. 2016. "Plastic Migration in drinking water with a temperature of 80°C by the type of polypropylene plastic cups", *International Journal of Current Research*, 8, (09), 38530-38532.

#### INTRODUCTION

Interaction between packaging to food is a process of transfer or migration of compounds derived from packaging into food products, especially packaging made of plastic, but it also can occur on the packaging are made from metal, glass, ceramics and paper (BPOM, 2005). Plastics have become part of life for plastic packaging has captured the world packaging market, replacing the cans and glass. Plastic packaging has dominated the food industry in Indonesia and flexible packaging (flexible) occupy a share of 80%. The amount of plastic used to package, store and wrap food / beverage accounted for 53% specifically for flexible packaging, rigid packaging while already widely for different types of drinks (Sulchan, 2007). One type of plastic that is often used as a beverage container that is practical and commonly used in the market in the form

of cup is the type of Polypropylene with monomer compound is Propilen. Polipropilena including olefins group, is violent, Polypropylene has a structure more resilient but has resistance against shock lower, resistant to chemical compounds except the aromatic solvent and hydrocarbon chloride in hot conditions. Polypropilena is a thermoplastic polymer that is made by the chemical industry and is used in various applications such as plastic bags, plastic cups, buckets and bottles (Asgar in Astrid, 2013). Plastic Polypropylene widely used as a cup for beverage containers by the hawkers and pavement cafés as a container substitute for glass, but the use Polipropilena often do not pay attention to the dangers of its use, because of the use of plastic Polypropylene at a temperature of heat of 80°C which can result in the migration of plastic. Bulletin BPOM in 2007 said factors that could affect the migration of plastic is the migration speed, surface area, contact time and temperature. At temperatures of 80°C has been able to affect the migration because at this temperature is the melting point of the plastic type of Polypropylene and usually people cook hot water until the water temperature starts to boil.

\*Corresponding author: Nany Djuhriah

Department of Environmental Health, Health Polytechnic Bandung, Babakan Loa 10A Cimahi Utara, Kota Cimahi

Old plastic contact with water at a temperature of 80°C greatly affect the activity of the compounds contained in Polypropylene polymer into the beverage contained in a plastic cup Polypropylene. On the results of the pre experiments conducted on the temperature and contact time by researchers at the Laboratory of Integrated Polytechnic of Bandung, decrease the temperature to 50°C is water began lukewarm, a decrease in temperature of 80°C - 50°C takes about 20 minutes, then the temperature water will begin to cool at a temperature of 35°C and takes approximately 30 minutes and the decrease in temperature conditions colder water at the time of 40 minutes so the researchers conducted the study after a contact time of 20 minutes, 30 minutes and 40 minutes.

Examination Polypropylene plastic compounds in the migration to drinking water conducted by researchers using the tool Gass Cromathography Mass Spectrophotometer to see the migration activity of compounds contained in a plastic cup packaging made of Polypropylene. By means Gass Cromathography Mass will be visible spectrophotometry highest migration activity, it indicates that the compound was allegedly contained in plastic. Based on the examination results are qualitatively the hazardous substances contained in plastic Polypropilena is Styrene and pthalic acid. By knowing the chemical compound it will provide health impacts that affect carcinogenic trigger cancer (BPOM and Sulchan, 2007). Research on the migration of plastic has much to do with different types of plastics are tested, such as the journal of the Analysis The content of formaldehyde in drinks Youghurt In Plastic Packaging polyethylen Tereftalate (PET) and high density polyethylen (HDPE) by Subardi, while the journal of research on Analysis of Migration Formaldehyde In Mineral water In Plastic Containers polyethylen Terephthalate (PET) by Khoirul and Sulchan Journal by the Food Safety Packaging Plastics and Styrofoam.

In accordance with article 19 in paragraph (1) states that the packaging is one part of the way food production is good and in paragraph (2) states that the procedure for the packing of food correctly is primarily intended for certain food that have a nature / specific characteristics that require treatment special for the packaging, such as food with high fat content or high-temperature food should not be packaged in plastic that can potentially carcinogenic release monomer into the food. With the issues and rules that have been described, it is to achieve good levels of food quality and protecting the rights of consumers to be tehindar of various contaminants in the food, the researchers want to conduct research on the effect of contact time on the activities of migration plastic drinking water temperature of 80°C.

## MATERIALS AND METHODS

This type of research is experimental, this study aims to determine the effect of contact time on the activities of the plastic migration in drinking water with a temperature of 80°C. The object of research is the whole object of the study or the object under study. The object of this research is drinking water with a temperature of 80°C. The sample in this study is drinking water with a temperature of 80°C, a sample size that is defined in this study is based on the number of treatments

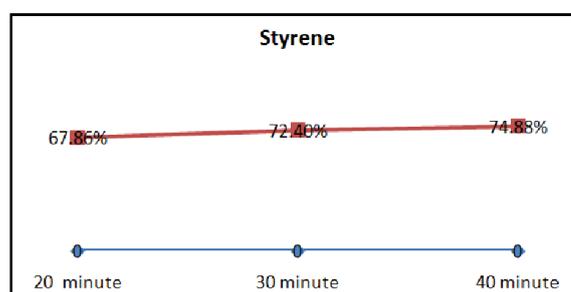
and the number of repetitions of the treatment itself. The treatments used three kinds of contact time use polypropylene plastic that is 20 minutes, 30 minutes and 40 minutes. In determining the amount of repetition in this study calculated the formula according to Gomez (2007). Based on the calculation results showed that the number of repetitions (r) 6 times. In this study consisted of three treatment times, all of which are six repetitions. Thus the number of drinking water in plastic are a total of 18 plastic drinking water. This research was conducted at the Laboratory of Integrated Polytechnic of Bandung.

## RESULTS

Based on the results of the qualitative type of the compounds contained in the water after the migration is Styrene and Pthalic Acid, thus drinking water usually consumed by the public contain dangerous chemical compounds in accordance with the regulations BPOM that styrene is one of the harmful chemicals that can interfere human health.

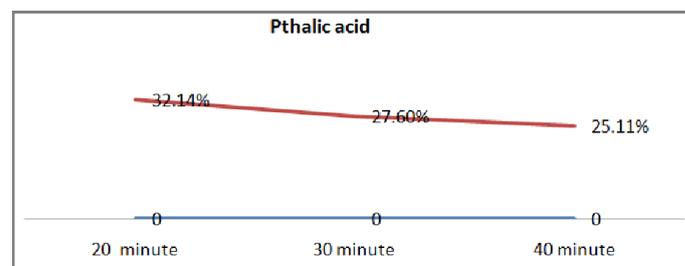
**Table 1. The content examination results compounds in packaging plastic cup in drinking water temperature 80°C**

No	Samples	type Compounds
1	Water with temperature 80°C (20 minutes)	Styrene and Pthalic Acid
2	Water with temperature 80°C (30 min)	Styrene and Pthalic Acid
3	Water with temperature 80°C (40 minutes))	Styrene and Pthalic Acid



**Figure 1. The average percentage Styrene Compounds Migration of Plastics In Drinking Water at temperatures of 80°C for contact 20 Minutes , 30 Minutes and 40 Minutes**

Based on Figure 1. The average percentage of migration of styrene compounds in drinking water with a temperature of 80°C was highest in the 40-minute contact time



**Figure 2. The average percentage Pthalic Acid Compounds Migration of Plastics In Drinking Water at temperatures of 80°C for contact 20 Minutes, 30 Minutes and 40 Minutes**

Based on Figure 1. The average percentage of migration Phthalic acid compounds in drinking water with a temperature of 80°C was highest in the 20-minute contact time

## DISCUSSION

Some of the reasons being the effect of migration of plastic in this study according to the rules BPOM head in the bulletin of 2007 states that, namely:

- The temperature treatment is carried out exceeds the maximum limit migration of styrene that can be seen the activity of compounds which increase because the higher the temperature of food or drink, the more plastic compound experiencing inward migration mixed with a drink while it's phthalic acid decreases the activity because of circumstances temperature began to decline within their physical properties phthalic acid should be at a temperature range of 15<sup>0</sup> C-25<sup>0</sup> C so as not to react so that the treatment is done it will result phthalic acid does not react again with increasing temperature in the cold water.
- The length of time that is done on styrene compounds sufficient to give time to the activities of styrene compounds to increase and accumulate, because the longer the contact time is done, it will increase the amount of the compounds contained. Phthalic acid compound with a given contact time will affect the temperature was not hot anymore and make phthalic acid does not react anymore.
- The surface area provided is so broad that it does not cause activity styrene compound to spread more widely and are only active on the existing surface area and a buildup of compounds happens to fall down not to the side to make these compounds will take longer to evaporate.

## Conclusions

Based on the research that has been done and after execution of data analysis, it can be concluded as follows:

- Based on the results of the migration Polypropylene plastic, chemical compounds are styrene and phthalic acid is a hazardous chemical compounds and compounds that should be on the type of plastic styrofoam instead of plastic Polypropylene.
- The mean results of the presence of compounds with activity styrene compounds migration in contact time 20 minutes 67.856%, 72.403% 30 minutes and 40 minutes 74.881%, it can be seen that the activity of styrene compounds will increase the contact time is longer.
- The mean results of the activity of the compound where phthalic acid on contact time of 20 minutes is 32.144%, 27.596% was 30 minutes and 40 minutes is 25.119%, it can be seen that the activity of the compound phthalic acid will decrease the contact time is longer.
- Results of statistical tests (Kruskal Wallis) at 5%  $\alpha$  values obtained  $P = 0.001$ , then  $P < \alpha$  thus obtained  $H_0$  rejected the decision, that there was an effect on the activities contact time migration Polypropylene plastic drinking water temperature of 80°C, the activity phthalic acid compound that is no influence of contact time on the activities of Polypropylene plastic migration in drinking water temperature of 80°C.

## REFERENCES

- Astrid, 2013. Shelf Life Prediction Crackers Kemplang In Plastic Packaging Polypropylene Some thickness. *Journal of Agricultural Engineering Lampung*, Vol 2 No. 02. Lampung
- BPOM RI, 2005, 13th Edition Packaging News April-May 2005. packaging Indonesia Federation.
- BPOM RI, 2007. Food Safety, RI BPOM Bulletin, Vol.12, p.2.
- Sharif rizal 2010, Advanced Food Packaging Technology, January 22014, [http://ocw.stikom.edu/course/download/2013/05/28-03-2013.11.51.31\\_802\\_390903040\\_Chemical-Mechanical-D3-KGC\\_P1\\_Pert6\\_2.pdf](http://ocw.stikom.edu/course/download/2013/05/28-03-2013.11.51.31_802_390903040_Chemical-Mechanical-D3-KGC_P1_Pert6_2.pdf)
- Sulchan mohammad and Endang nur 2007, the Food Safety Packaging Plastic and Styrofoam, Master of Medicine, Indonesia, Vol.57, p.56.

\*\*\*\*\*