식품 첨가제와 탈취제로 이용하기 위한 목초액 실험

나애경, 이정호, 송승화, 김 효*
서울시립대학교 화학공학과
(hkim@uos.ac.kr*)

Pyroligneous Liquid Experimental for Food Additive and Deodorant

Aekyoung Na, Jeongho Lee, Seunghwa Song, Hyo Kim*
Dept. of Chemical Engineering, University of Seoul
(hkim@uos.ac.kr*)

Ⅰ. Introduction

During the process, carbonizing woods to charcoal, the gas is liquefied to pale brown liquid called pyroligneous liquid.

The liquid, also called pyrolysis oil, pyroligneous acid, wood vinegar, liquid smoke, consists mainly of water. Organic compounds, phenol, neutrals, carbonyl compounds, base are also found in pyroligneous liquid.

However, the compositions of pyroligneous liquid is extremely complex, so only the major constituents can be mentioned as they are varied with types of woods carbonized. Pyroligneous liquid has traditionally been used as an insect repellent, deodorizer, antibacterial agent, sterilizer, alkaline bath and wash, and food additive. This paper will focus on fabricating the liquid to food additive and deodorizer[4].

To use pyroligneous liquid as a smoky flavor food additive, methyl alcohol in the liquid should be less than 50ppm according to KFDA.

The crude pyroligneous liquid has some problems to use as a deodorizer directly. But once the problems are solved, then it will be excellent deodorant.

Ⅱ. Methanol Removal

1. Previous works

The desired product as a food additive is obtained by distilling the pyroligneous liquid twice. At the first distillation, the pyroligneous liquid is distilled under the conditions of 260mmHg and 50℃ until all the liquid changes into vapor (see Figure 1). The vaporized liquid is then cooled down to "once-distilled-liquid", then all of the solid components in the pyroligneous liquid have been separated.

However, the "once-distilled-liquid" is still not available to drink, for too much methanol in which it has. Further distillation is needed to reduce methyl alcohol.

A certain amount of water is added to the "once-distilled-liquid" before the second distillation. The pressure and temperature as well as the ratio of water and pyroligneous liquid are significant factors to determine how much methanol decrease. The optimum ratio is estimated around 2 to 3 (water to pyroligneous) under 65℃ as considering both of KFDA's standards and the economic

interest (see Figure 2).

2. Experimental (The second distillation)

In the real factory process, a mixture of estimated optimum ratio (once-distilled-liquid 300L : water 200L) was distilled. Only the pressure conditions were varied from 550mmHg to 650mmHg at the constant temperature of 65℃. However, all the results came out failure.

From the results of the laboratory scale experiments, it has come out very clear that more water should be added to the once-distilled-liquid to reduce methyl alcohol. Moreover, the pressure condition does not effect so much to the met

hanol reduction as long as it is somewhere between 600mmHg and 650mmHg.

Thus, new ratio of once-distilled-liquid and water have been introduced to reduce methanol more, and the results are shown in Figure 4.

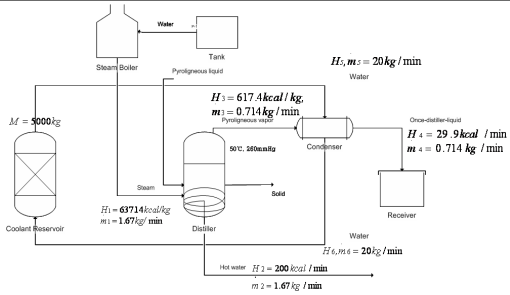

Figure 1. Flow chart for the first distillation process. Solid components in pyroligneous liquid is separated from the process. Temperature is 50℃, and pressure is 260mmHg.

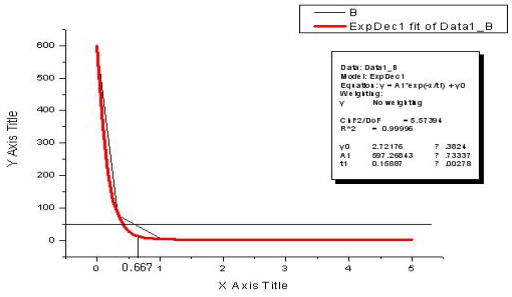

Figure 2. Methanol in pyroligneous liquid decreases drastically until ratio of 0.667(water / pyroligneous lqiuid), which seems optimum mixing ratio.

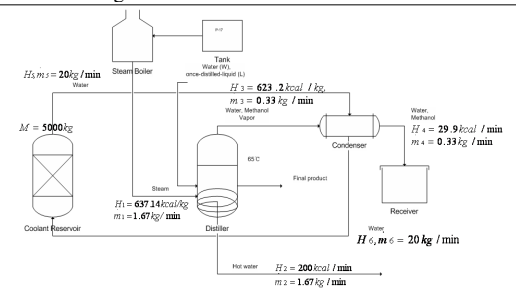

Figure 3. Flow chart for the second distillation process (W=200L, L=200L). Input is the mixture of water and pyroligneous liquid. Methanol in pyroligneous liquid is reduced from the process. Temperature is constantly kept at 65℃, but pressure and mixing ratio are varied.

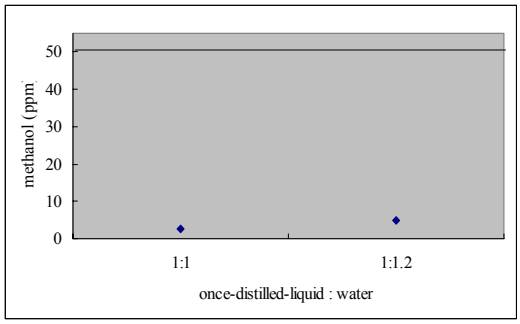

Figure 4. Both of ratios are perfectly successful as it is much lower than the standard 50ppm. The red line is the standard.

3. Conclusions

To use pyroligneous liquid as a food additive, several process was needed. The first process is to obtain crude pyroligneous liquid by cooling and condensing the air and gas from traditional process of producing charcoal by burning woods in a firebrick chamber. The crude pyroligneous liquid is vertically separated to three parts. Removing the upper and bottom, then pyroligneous liquid is obtained.

Then, the pyroligneous liquid is distilled twice. The first distillation is under the conditions of

260mmHg and 50℃ until all the liquid is vaporized. The vaporized liquid is then cooled down to the "once-distilled-liquid" as all the solid components in the pyroligneous liquid have been separated.

Next, the "once-distilled-liquid' is once more distilled. Before the distillation, same amount of water as "once-distilled-liquid" is added. The conditions of distillation are 600mmHg and 65℃, and the process continues until same amount of liquid as added water is removed.

The final product passes every single standard of KFDA to use it as a food additive.

4. Further works

The productivity is one of the most important factors as this process is for mass production. The second distillation process has been observed too much time consuming works as it takes around 10 hours to produce 200L of final pyroligneous liquid. Here, a method is suggested to reduce the distilling time dramatically.

Energy loss should be as little as possible by minimizing the heat diffusion and re-using the energy that coolant water obtain. Too much energy is being wasted by heat diffusion during the process. The distiller should be wrapped by insulators, and the wasted hot water to the vent must be re-used.

Ⅲ. Deodorant

1. Principles of odor removal

People can smell something because the material is volatile. Most of chemical components of odors around us have been analyzed. For example, smell of restroom or meat is ammonia (NH_3), *kimchi* is methyl mercaptan (CH_3SH), decomposed eggs or milk are hydrogen sulfide (H_2S), and fishy smell is trimethylamine ($(CH_3)_3N$).

Human civilization have tried to remove those smells, and some people have used pyroligneous liquid as a deodorant for a long time. The principles mainly are masking, sterilization and chemical reaction (see Figure 5).

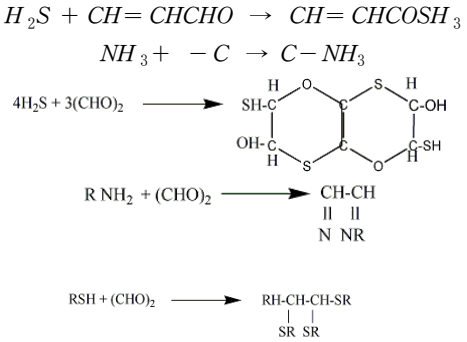

Figure 5. Pyroligneous liquid removes the chemical compounds by reaction[7].

Nowadays it is again used as deodorant especially for a landfill. Here, experiments that expand its deodorant usage to textile will be introduced. However, the pyroligneous liquid itself also has its own peculiar smoky smell, so it is hard to use it to textile or fiber without any process.

2. Hypothesis

To reduce its own smoky smell, a couple of ways are here suggested. First, it is able to be

masked by other scent such as cypress french, orange, lemon or peppermint. Second, the smoky smell is absorbable to active carbon.

3. Experimental

3.1. *Masking method*

When pyroligneous liquid is diluted more than 10 times by water, its own smoky smell is fairly reduced while its effectiveness of odor removal is still good. Hence, 10 and 20 times of water have been added to pyroligneous liquid before making its smoky smell with others[3]. With 0.1㎖ of cypress french, orange, lemon, peppermint or mixture of any of them, the smoky smell of 110㎖ or 210㎖ of diluted pyroligneous liquid is almost totally reduced. However, the smell of masking materials was still problem.

3.2 *Absorbent method*

Activity carbon could be effective to reduce its own smoky smell. It should be avoided that pyroligneous liquid contacts directly activity carbon because it can absorb too many things. Thus, indirect ways to absorb the smoky smell are suggested in Figure 6.

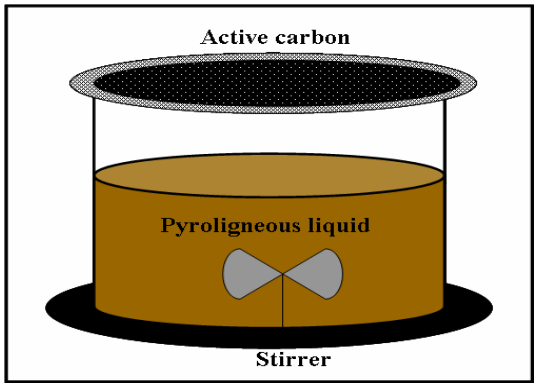

Figure 6. Suggested way of removing its own smoky smell. Activity carbon is placed over the liquid.

Ⅳ. References

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