Gas Emissions and Sugar Compositions of Different Wood Species of Plywood Used in Museums

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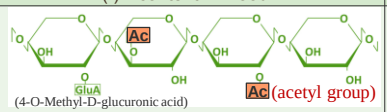
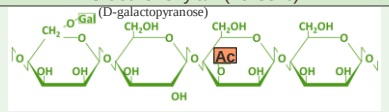
1. Introduction

It is well known that gases cause adverse effects on artifacts are emitted from plywood. Wood veneer is considered one of the main sources of acetic acid emissions from plywood. Acetic acid emissions from wood are attributed to the hydrolysis of acetyl groups in the hemicellulose (Table 1).
This study was conducted to investigate the relation between the xylose content and acetic acid gas emission.

Table 1. Structure of xylan and glucomannan in hemicellulose.

	Structure ( )…content in wood[1)]	Acetyl group content (%) [1)]
Hard wood		9 - 14
	Glucuronoxylan (19-35%)	
Soft wood		4 - 9
	Galactoglucomannan (12-18%)	

2. Experiment

【Samples】Sample veneer was kept in cushioning material from production until experiments.

Table 2. Sample list

	Wood species	Size(mm)
Hard wood	Meranti (***Shorea sp.***)	450 × 450 × 4
	Kapur (***Dryobalanops sp.***)	
	Keruing (***Dipterocarpus sp.***)	
Soft wood	Japanese red pine (***Pinus densiflora***)	

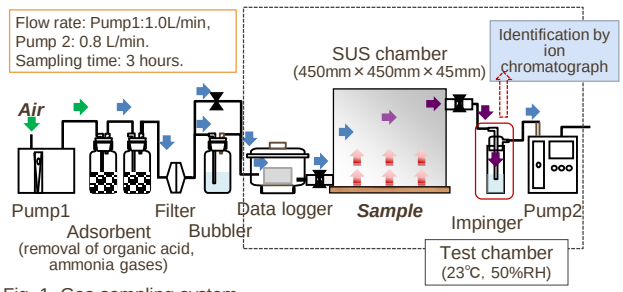


Fig. 1. Gas sampling system.

【Method】

■ **Emission test** focusing on acetic acid was conducted by following the chamber method [2)] (Fig.1). This emission test was carried out on no seasoning and after 21 days of seasoning of samples at 23 ℃ and 52 %RH.

1. Sample veneer was placed under a SUS chamber (Fig.1).
2. Air flowed through adsorbent materials, a filter and a bubbler to the SUS chamber as clean air of 50 %RH.
3. The air mixed emission gas from sample was caught by pure water in an impinger outside the chamber.
4. Components in the pure water were identified by using ion chromatograph(DIONEX ICS-5000).

■ **Analysis of neutral sugar composition** confirmed the xylose content of each wood species. The analysis was performed by following the alditol acetate method.

1. Wood meal samples were hydrolyzed with 72 % sulfuric acid for 4 hour at room temperature. As second hydrolysis, samples were hydrolyzed with 4 % of sulfuric acid for 1 hour at 120℃. *Myo*-inositol was added as internal standard.
2. The hydrolysate was neutralized with barium hydroxide solution and precipitate of barium sulfate was removed by centrifugation.
3. Hydrolysate was reduced sodium borohydride and it was acetylated with acetic anhydride.
4. Alditol acetates were analyzed with the gas chromatograph (SHIMADZU GC-2010 Plus).

3. Results

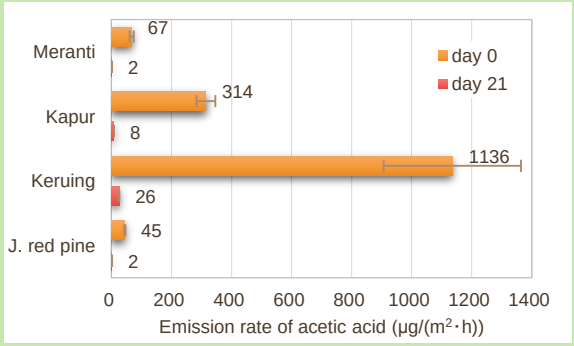


Fig. 2. Emission rate of different wood species.

- The emission rates were different for each hardwood species.
- Emission rates of hardwood species were greater than that of the softwood species, Japanese red pine.

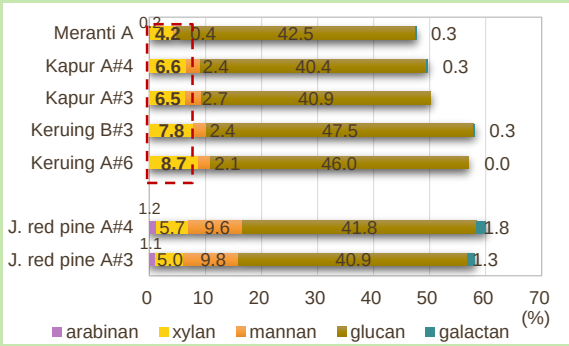


Fig. 3. contents of monosaccharide.

The xylose contents were different for each hardwood species.

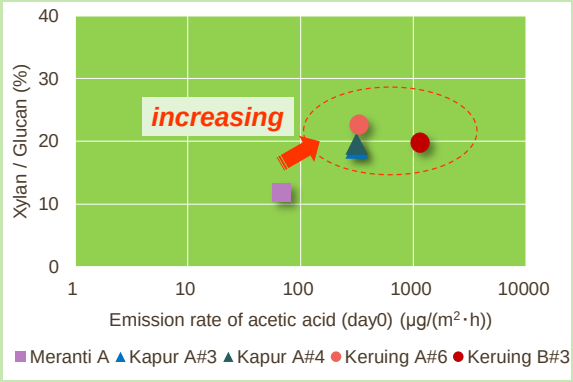


Fig. 4. Emission rate and xylan to glucan ratio.

The emission rate increases when amount of the xylose component increases.

4. Conclusion

- **The xylose contents of wood has an effect on emission rate of acetic acid.**
- **It is inferred from these results that acetyl group content is different for each wood species and sugar composition is relevant to acetic acid gas emissions.**

【Reference】1) Hon, N.-S. D. Shiraishi, N. (2001). *Wood and Cellulosic Chemistry.* New York: M. Dekker.INC. 2) Kotajima, T., Ro, T., Sano, C. (2012). *Hozon kagaku*, 51, 271-279.