RECENT RESEARCH ACTIVITIES

Production and identification of antiviral compounds from lignocellulosic biomass

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There is an increasing demand to establish sustainable society by replacing fossil resources to renewable bioresources. Biomass is the alternative carbon resources contributing reduction of green house gas emission and the energy crisis owing to depletion of fossil fuels. To establish the biomass-based society, production of value-added products is required in addition to production of biofuels, materials and commodity chemicals from biomass. In addition to the demand from the resource depletion and green house gas emission, we are now facing the crisis of pathogenic virus infection due to the global warming and globalization of transportation. If we could produce antiviral compounds from lignocellulosic biomass such as waste wood and agricultural residues, the process contributes to the establishment of biorefinery and suppression of expansion of pathogenic viruses. In the first step of the research strategy, we studied antiviral compounds involved in pyroligneous acids (PAs).

PAs, also called wood vinegar, pyroligneous liquor, pyrolysis bio-oil, or liquid smoke, are the crude condensate of smoke produced through carbonization, and consist of a pyrolyzate of cellulose, hemicelluloses, and lignin. Wood and bamboo PAs are complex mixtures of water, alcohols, organic acids, esters, aldehydes, ketones, phenolics, and nitrogen compounds. Acetic acid is the primary component of wood and bamboo PAs. We have been analyzing antiviral activities of PAs from hardwood, softwood and bamboo against EMCV to identify the compound responsible for the biological activity.[1,2] All the PAs except for Japanese red pine wood exhibited strong antiviral activity. Twenty-five kind of phenolic derivatives in the PAs were identified and quantified. An assessment of the antiviral activity of all the phenolic compounds against EMCV demonstrated that they are strongly dependent on the functional groups and their relative positions attached to the aromatic ring. More potent antiviral activities were determined for catechol and its derivatives. The antiviral activities of phenolic compounds with methyl groups are higher than those of compounds with methoxyl groups.[1]

These results present a new strategy to optimize the production of antiviral agents from PAs by monitoring the concentration of each phenol derivative from different plant origins. Understanding the structure-activity relationship of phenol derivatives will lead to the synthesis of more effective agents for virus-inactivation treatments. In addition to the analysis of PAs, research on production of antiviral compounds by microwave catalytic reactions of woody biomass and sugarcane bagasse is in progress.

Acknowledgements

We acknowledge Mission 5-1-1 Research Programs and ADAM, of Research Institute for Sustainable Humanosphere (RISH), Kyoto University. We indebted coworkers and collaborators of the reesarch programs, Dr. Shinsuke Marumoto, Dr. Seiji P. Yamamoto and Emer. Prof. Mitsuyoshi Yatagai.

References

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