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# Bio-Remediation Potential of Hydrolytic Bacteria Isolated from Hospital Liquid Biomedical Waste in Central Java

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## Extended Abstract

Hospital plays an important role as a health-care center facilitating prevention, treatment, rehabilitation, and promotion to maintain and improve public health [1]. Currently number of hospitals in Indonesia increases significantly supported by the issuance of government regulations aiming at encouraging business investment and hospital services [2]. In a case, total number of hospitals in Central Java Province raised from 247 to 263 units in 2012. Nevertheless, such increase was not followed by improvement in service quality as evidenced by the General Mortality Number of Patients Treated in Hospital (GMNPTH) of the province (59.4) in the same year, which exceeded the tolerated limit (45.0) [3].

The increasing number of hospitals in Indonesia including in Central Java raises environmental concern due to greater amount of discarded biomedical wastes exposing high risk of pathogenic microbes, toxic chemicals and radioactive materials affecting public health. The possible risk and negative impacts of hospital waste demand each hospital to treat their waste per state's regulation, the Peraturan Menteri Lingkungan Hidup Indonesia No. 5/ 2014 [4]. However, construction of Waste Water Treatment Plant (WWTP) to treat liquid biomedical wastes is still costly [5], while incinerator widely used in hospitals to treat solid biomedical waste is not environmentally friendly [6]. Results of rapid assessment by Dirjen P2MPL of Dinas Kesehatan Republik Indonesia in 2002 stated that from 648 units of 1,476 hospitals in Indonesia, those having incinerator and WWTP were only 49% and 36%, respectively. Under such condition, the quality of processed liquid waste that meets the qualification was only 52% [7]. This review addresses hospital liquid biomedical waste problem in Central Java and highlights the potential use of local, non-pathogenic, hydrolytic, bacteria isolated from hospital liquid clinical waste reservoir as potential bio-remediation agent to handle the increased amount of biomedical wastes from hospitals.

Hydrolytic bacteria are widely known to play significant role in improving wastewater quality parameters such as COD, BOD, NH4, and PO4 of organic wastes [5]. While the pathogenic ones have been intensively studied for their genes to understand their pathogenesis mechanism [8], the non-pathogenic ones are believed to play important role in accelerating degradation of biomedical wastes. Such accelerated degradation by non-pathogenic hydrolytic bacteria will likely limit available nutrients suppressing the proliferation of pathogenic microorganisms, thus reducing the potential danger of infection and contamination they cause. It is also known that liquid biomedical waste reservoir containing debris of organic matters generated from clinical activities is a rich source of the hydrolytic bacteria. This indicates that hydrolytic bacteria could be very potential to be isolated and tested for their bio-remediation ability.

On the other hand, screening of bacteria capable of producing extracellular hydrolytic enzymes could be performed handily by plate tests, while their identification basically could be done based on Bergey's Manual of Systematic Bacteriology and the analysis of 16S rRNA genes [9,10,11]. It means all steps from bacterial sampling, isolation and bioremediation tests could be done using commonly available microbiology laboratory methods making these studies are convenient, yet prospective to do. Results of literature studies showed that theoretical strategies to conduct evaluation of the potential of hydrolytic bacteria isolated from hospital liquid biomedical waste as bioremediation agents could be visibly drawn from all those mentioned resources.

Upon completion of this review, knowledge on the degradation of the hospital biomedical wastes, which mainly consist of organic matters, enhanced by microbial hydrolytic enzymes offers great potential. Since reports on bioremediation of biomedical wastes are much rarer than those of other waste types, then researches aiming to isolate bacteria capable of producing hydrolytic enzymes such as lipase, protease and amylase are necessary to understand these bacteria's diversity and to find bio-remediation agents from this microorganism group for more environmentally friendly treatment of biomedical wastes. As conclusion, it may be considered that using hydrolytic bacteria isolated from clinical waste reservoir are better strategies for hospital liquid biomedical waste remediation in Central Java.

***Keywords***: Bacterial bio-remediation, hydrolytic bacteria, biomedical waste, liquid hospital waste

## References

[1] Kepmenkes (Indonesian Health Decree No: 659/MENKES/PER/VIII/2009 Date August 14, 2009) about Standards and Criteria of World-Class Indonesian Hospitals, [Online]. Available: http://www.pdpersi.co.id/peraturan/permenkes/pmk6592009.pdf

[2] MDR (Media Data Riset), "Profil Rumah Sakit Swasta di Indonesia," PT Media Data Riset, 2013 [Online]. Available: https://www.scribd.com/doc/134811730/PROFIL-RUMAH-SAKIT-SWASTA-DI-INDONESIA-2013

[3] D. K. P. J. Tengah, "Buku Profil Kesehatan Provinsi Jawa Tengah Tahun 2012," Semarang, Dinas Kesehatan Provinsi Jawa Tengah, 2013, [Online]. Available: http://www.depkes.go.id/resources/download/profil/PROFIL_KES_PROVINSI_2012/13_Profil_Kes.Prov.JawaTengah_2012.pdf

[4] A. Junairi, "Evaluasi Kinerja Instalasi Pengolahan Air Limbah (IPAL) Unit Sistem Advanced Oxidation Processes dalam Pengolahan Limbah Cair RSUD DR. H. Yuliddin Away Tapaktuan," M.S. thesis, Dept. Chem. Eng. Universitas Syiah Kuala, Aceh, 2014.

[5] Y. S. Mora, "Evaluasi Dimensi Unit Instalasi Pengolahan Air Limbah Domestik Rumah Sakit dr. Ernaldi Bahar Kota Palembang," *Jurnal Dampak*, vol. 12, no. 2, 2015.

[6] V. Gautam, R. Thapar and M. Sharma, "Biomedical waste management: Incineration vs. environmental safety," *Indian journal of medical microbiology*, vol. 28, no. 3, pp. 191, 2010.

[7] D. K. R. Indonesia, Departemen Kesehatan Republik, "Pedoman Sanitasi Rumah Sakit di Indonesia," *Jakarta, Pusdiknakes*, 2002.

[8] S. N. Ethica, E. Semiarti, J. Widada, O. Oedjijono, and T.J. Raharjo, "Characterization of moaC and a nontarget gene fragments of food-borne pathogen Alcaligenes sp. JG3 using degenerate colony and arbitrary PCRs," *Journal of Food Safety*, vol. 00-e12345, https://doi.org/10.1111/jfs.12345.

[9] A. Emimol, G. Ganga, R. Parvathy, G. Radhika, and G.M. Nair, "Screening of microbes producing extracellular hydrolytic enzyme from corporation waste dumping site and house hold waste for the enhancement of bioremediation methods," *IOSR-JPBS*, vol. 4 pp. 54-60, 2012.

[10] S. N. Ethica and T.J. Raharjo, "Detection of Genes Involved in Glycerol Metabolism of *Alcaligenes sp. JG3*," Doctoral dissertation, Biotech. Study Program, Grad. School of Universitas Gadjah Mada, Yogyakarta, 2014.

[11] K. S. Mwaikono, S. Maina, A. Sebastian, V. Kapur, and P. Gwakisa, "16S rRNA Amplicons Survey Revealed Unprecedented Bacterial Community in Solid Biomedical Wastes." *Am. J. of Micr. Res*, vol. 3.4, pp.135-143, 2015, https://doi.org/10.12691/ajmr-3-4-3.