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Held on 22 October 2019 at Gets Hotel, Semarang, Indonesia

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Potential of phytotechnology in wastewater treatments to produce alternative electrical energy: A review

Zaman B. ; Samadikun B.P.; Budihardjo M.A.; Hardyanti N.; Rachma A.F.; Hasna S.I.
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Abstract

Recently, phytotechnology has gained much attention due to its capability in treating wastewater by

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PREFACE

The 9th International Seminar on New Paradigm and Innovation on Natural Sciences and Its Application (ISNPINSA-9) is annual seminars organized by Faculty of Sciences and Mathematics (FSM) Diponegoro University and has been successfully conducted since 2011. The ISNPINSA-9 was held in Semarang, Indonesia on October 22th 2019. The aims of ISNPINSA are to facilitate brain storming and state of the art information in field of sciences and mathematics; to increase innovation of technology that can be applied in industries; to contribute in formulating strategy to increase the role of science for community; and to stimulate collaboration between industries, researchers and government to increase community welfare. The theme of 9th ISNPINSA in 2019 is "CONTRIBUTION OF SCIENCE TOWARD INDUSTRY 4.0 ERA".

The number of participants of the seminar were 210 including keynote speakers, invited speakers, oral presenters, poster presenters, and non-presenters coming from various institutions of various countries, including France, Malaysia, Indonesia and those who come from all parts of Indonesia consist of researchers, lecturers, postgraduate and undergraduate students from various universities. There are 169 papers were presented in this seminar, consist of 4 keynote speakers, 6 invited speakers, oral presentations, and 9 poster presentations. After the selection process, there are 149 articles selected papers to be published in the present conference proceeding. The scope of the field of participants comes from various fields including biology, physics, chemistry, statistics, mathematics, informatics, environment, public health, and relevant fields that contribute to sustainable development.

The Chief of Editor

Dr. Suryono. S.Si., M.Si.

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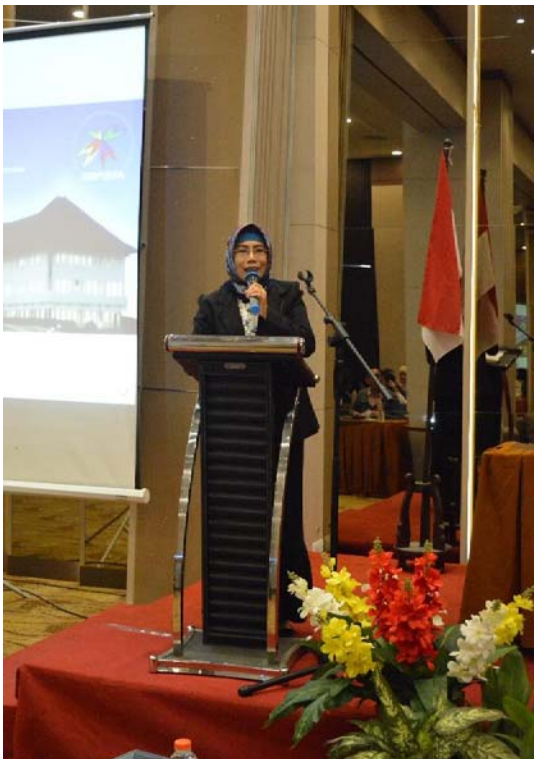

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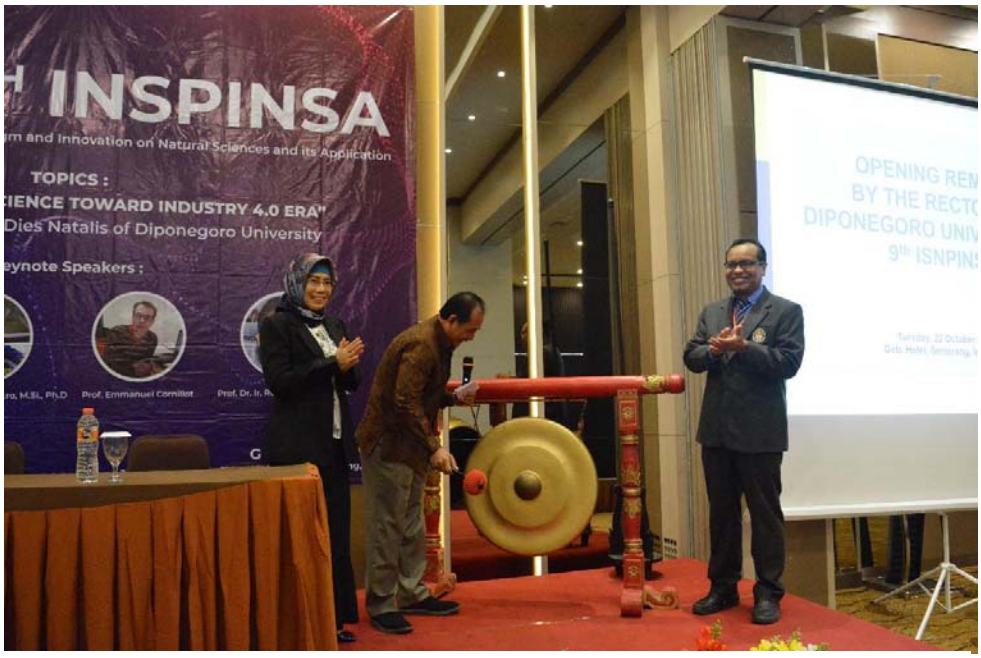


The opening ceremony of the 9th ISNPINSA through hitting the Gong by Vice Rector of Diponegoro University

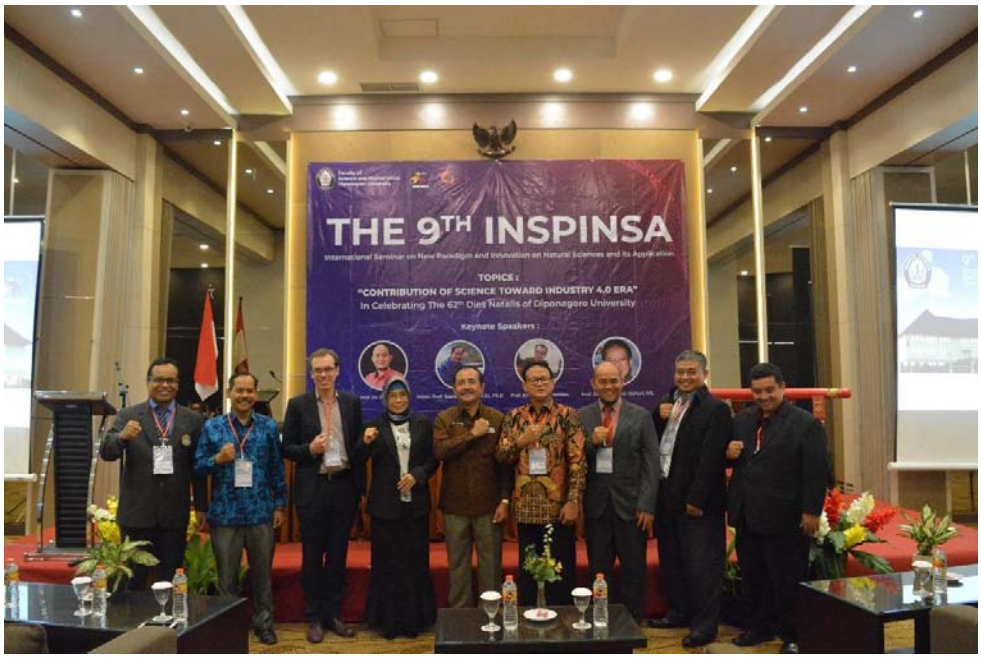
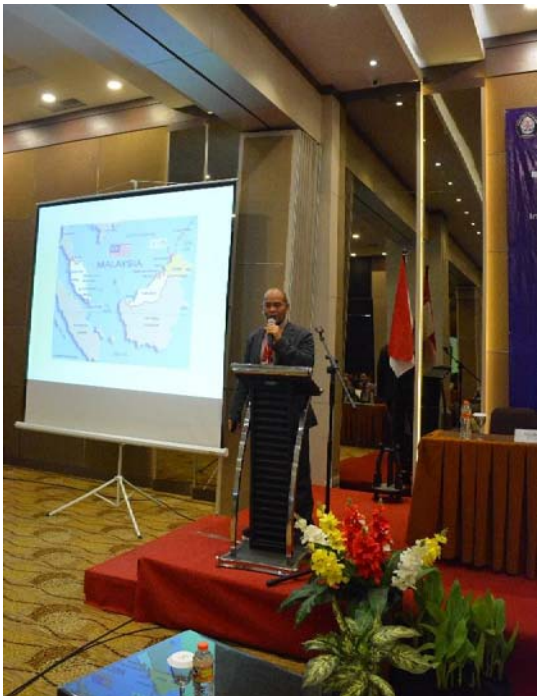
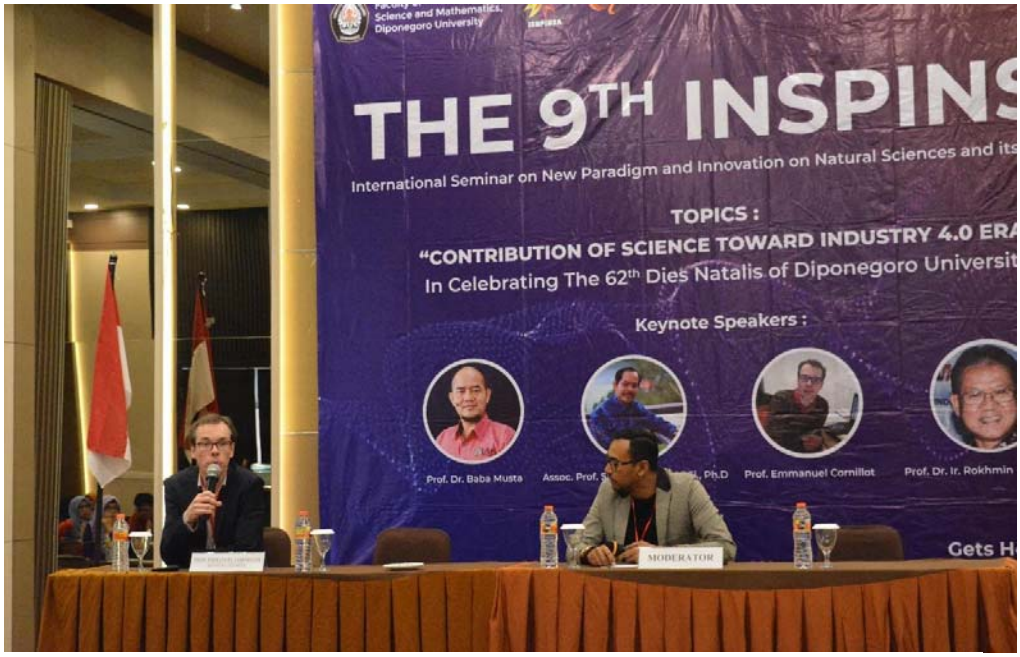


Photo Session included Keynote speakers, Vice Rector of Undip, Dean, and Vice Dean of FSM Undip



Plenary Session by Prof. Dr. Baba Musta (Fac. Science, Universiti Malaysia Sabah, Malaysia)



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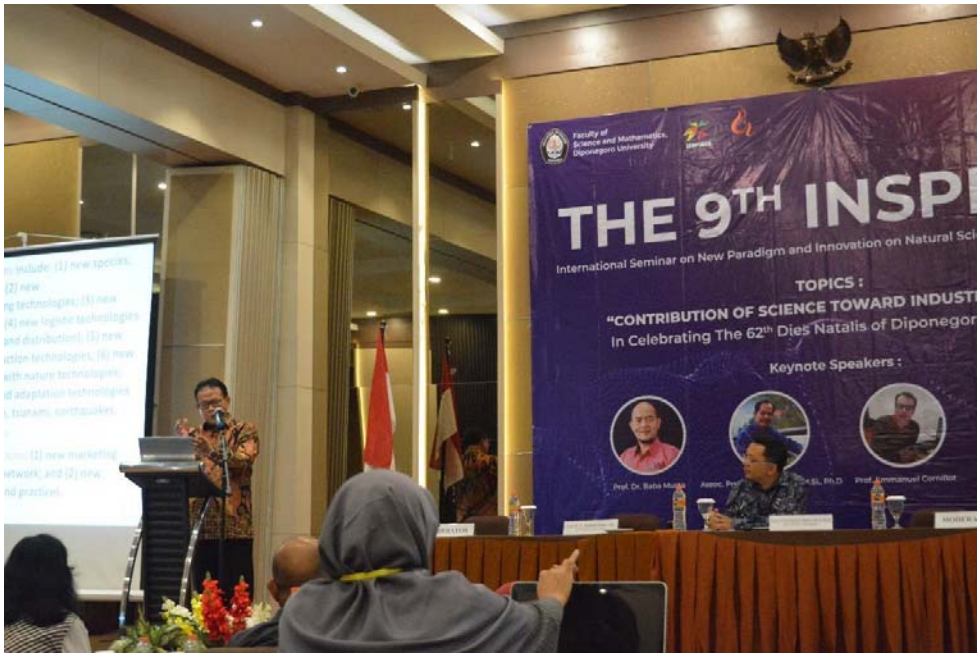
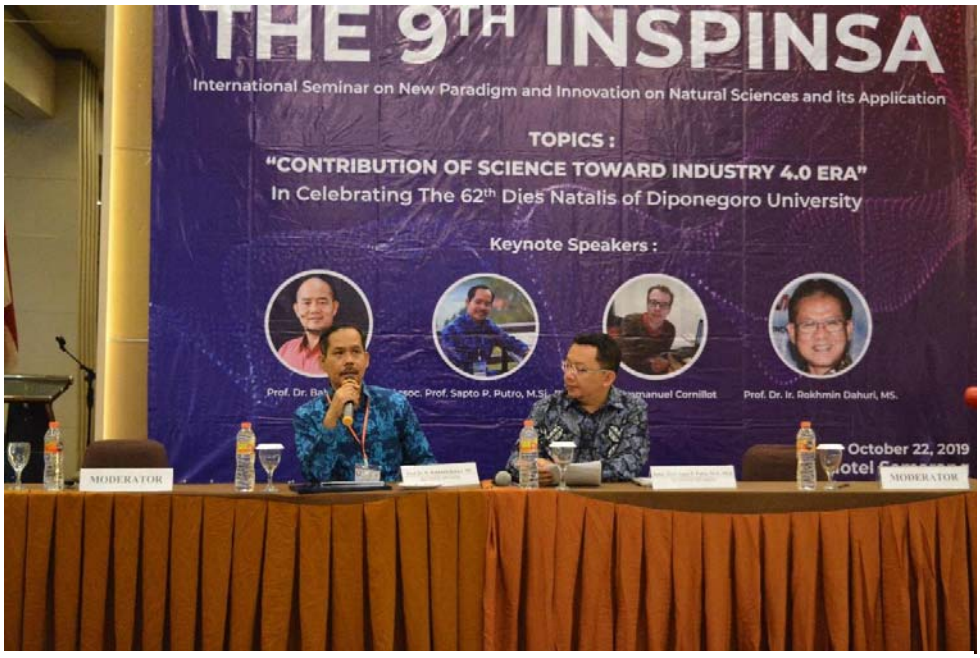
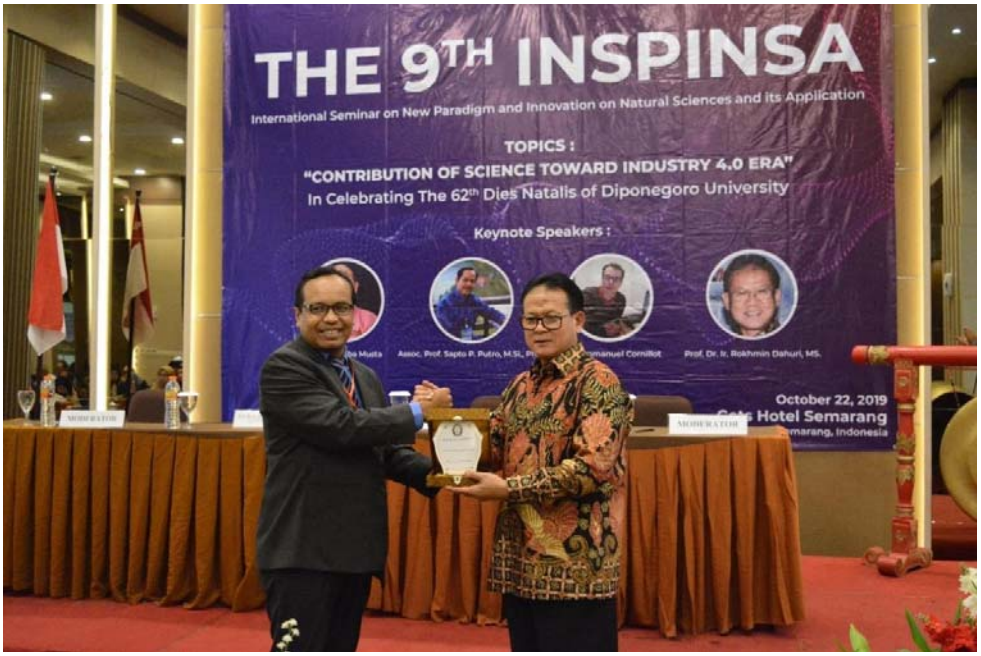


Plenary Session by Prof. Dr. Ir. Rokhmin Dahuri, MS. (Former minister of Fisheries and Maritime Affairs, President of Indonesian Aquaculture Society; Proffesor in Marine Resource and Environmental Studies)



Plenary Session by Sapto P Putro, M.Si., Ph.D. (Diponegoro University, Semarang)



The chairman of the 9th ISNPINSA extend his gratitude to the one of keynote speaker Prof. Dr. Ir. Rokhmin Dahuri, MS.

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1.	Prof. Emmanuel Cornillot	Biotechnology	Universite de' Monpellier	Perancis
2.	Prof. Dr. Baba Musta	Geochemistry	Faculty of Science, UMS	Malaysia
3.	Prof. Dr. Ir. Rokhmin Dahuri, MS.	Marine Resource and Environmental Studies	President of Indonesian Aquaculture Society; Proffesor in Marine Resource and Environmental Studies	Indonesia
4.	Sapto P. Putro, M.Si., Ph.D.	Marine Ecology and Aquaculture	Faculty of Science and Mathematics, Diponegoro University	Indonesia

II. Invited Speaker

No.	Name	Department	Institution	Country
1.	Dinar Mutiara Kusumo Nugraheni, S.T., M.InfoTech.(Comp).	Computer Science	FSM UNDIP	Indonesia
2.	Dr. Eng. Ali Khumaeni, S.Si., MS	Physics	FSM UNDIP	Indonesia
3.	Dr. M. Cholid Djunaidi, M.Si.	Chemistry	FSM UNDIP	Indonesia
4.	Dr. Lilih Khotimperwati, S.Si., M.Si.	Biology	FSM UNDIP	Indonesia
5.	Dr. Tarno, M.Si.	Chemistry	FSM UNDIP	Indonesia
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Potential of phytotechnology in wastewater treatments to produce alternative electrical energy: a review

B Zaman, B P Samadikun, M A Budihardjo, N Hardyanti, A F Rachma, S I Hasna

Department of Environmental Engineering, Faculty of Engineering, Diponegoro University, Tembalang, Semarang, Central Java, Indonesia 50275

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Abstract. Recently, phytotechnology has gained much attention due to its capability in treating wastewater by biological processes. Phytotechnology is the application of science and engineering to examine environmental problems and provide solutions by the direct use of plants for in situ removal or degradation of contaminants or improving environmental function and quality. This process using bacteria formed in the roots of the plant and it can be applied to treat the wastewater. In this phytotechnology process, it presents the potential for energy generation and comprehensive wastewater treatment in Microbial Fuel Cell (MFC) system, which in the process utilizes bacteria that can produce alternative electrical energy because of the activity of bacteria which can self-mediate electrons to the anode through contact between the membrane-anode. MFC are expected to be applied to energy-saving wastewater treatments (WWT). The combined of MFC and phytotechnology system have function to degrade organic compunds and remove contaminant contained in wastewater to produce bacterias that come out in the roots and then the bacterias will be used by electrodes to produce electricity. This paper will analyze the advantage and disadvantages of phytotechnology system while used to produce electrical energy by MFC system as hybrid system. Based on the existing research, show that phytotechnology has a lot of advantages. One of the advantages is promising low cost, highly efficient, and renewable energy-producing alternative to conventional wastewater treatments.

1. Introduction

The application of phytotechnologies which is a combination of science and engineering will involve the use of plants to prevent, reduce or restore wastewater that exists in the ecosystem. Plants can also be used as indicators to monitor and assess the health of ecosystems [1]. In the phytotechnology system, an in situ approach is used, so native plants are more recommended in the application of this system. In most applications, plants that are adapted to local conditions will have better chances of success than non-adapted plants [1]. Wastewater treatment must be done because it is one of the most basic sanitation needs to protect the environment and water bodies. Wastewater is complex substrates, rich in organic carbon and nutrients, as well as energy [2]. First, it provides an overview of current energy needs for wastewater treatment and potential energy recovery options followed by a comprehensive review of the principles of wastewater treatment, substrate utilization (organic removal), recent process developments, nutrient and metal removal capacities in microbial fuel cells [3]. This wastewater is treatment is carried out in the phytotechnology process with the Microbial Fuel Cell (MFC) system to produce the potential energy because of the activity of bacteria that came out from the root of the plants which can self-mediate electrons to the anode through contact between the

Isolation and identification of rare actinomycete-like bacteria from soil-based on 16S ribosomal RNA gene sequences

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Abstract. The rare actinomycete-like bacteria are mycelium-forming bacteria other than phylum *Actinobacteria* that difficult to isolate and cultivate. This group of bacteria was recently speculated by many scientists as a potential new microbial resource for the discovery of novel compounds, as a substitute for actinomycetes. In this study, we isolate and identify rare actinomycete-like bacteria from forest soil collected under bamboo trees, near the CisolokGeysers, Sukabumi, Indonesia. The isolation of bacteria was performed using Reasoner's 2A (1:10 dilution) medium with 2% gellan gum instead of agar and incubated at 30 °C for three weeks. The 16S rRNA gene sequences of the isolates were examined to determine their taxonomic position. Four isolates designated K17-1, K17-2, K42, and K44 showed pale oranges colonies and formed mycelia were obtained. The results of 16S rRNA gene sequences of these isolates showed high similarity to members of the genus *Dictyobacter* in the family *Dictyobacteraceae* of the class *Ktedonobacteria* of the phylum *Chlorofexi*, with values 97.16-98.02%, and most closely related to the species *Dictyobacteraurantiacus* S-27^{T} (97.16-98.02% similarities). This result suggested that the member of the class *Ktedonobacteria*, which considered as rare actinomycete-like bacteria, such as *Dictyobacter* could be found in the forest soil of the geothermal area.

1. Introduction

Actinobacteria are gram-positive bacteria that have a high percentage of guanine and cytosine in their genome [1]. This group morphologically comprises unicellular organisms to mycelium-forming bacteria which called Actinomycetes [1,2]. However, bacteria that have filamentous appearance also could be found in the phylum *Chlorofexi*. The member of this phylum which has actinomycete-like morphology is present in the four different class namely *Chlorofexi*, *Anaerolineae*, *Caldilineae*and *Ktedonobacteria* [3]. Among these class, *Ktedonobacteria* has some obvious morphological features which distinguish themselves from others. The member of *Ktedonobacteria*are aerobic organism and forming branched mycelia with spores like actinomycetes [3,4]. Moreover, most validly published strains of *Ktedonobacteria*budding their multiple spores per cell on the aerial mycelium which unique among bacteria [5]. All of*Ktedonobacteria*identified as gram-positive bacteria while almost of the member in phylum *Chlorofexi* were gram-negative [3,6]. Based on these exceptional characters, class *Ktedonobacteria* could be included as the rare actinomycete-like bacteria.

Rare actinomycete-like bacteria could provide an alternative for the discovery of new compounds derived from microorganisms because spore formation usually would be followed by the production of secondary metabolites [7,8]. Further analysis of the genomic of nine members of rare actinomycete-like bacteria