

Short Communication

Pseudomonas aeruginosa, an Epidemiological Risk Strains Isolated in Hospital Environment

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A B S T R A C T

Keywords

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Pseudomonas aeruginosa isolated from hospital environmental surfaces were characterized and produce to different antibiotic resistance and heavy metal concentration, biosurfactants, pyocyanin, biofilms, as well as to measure their tolerance, growth on various carbon sources, antimicrobial resistance and resistance to heavy metals. hemolytic profile, all strains produced mono and dirhamnolipids. Resistant strains could lead to hospital outbreaks because of antibiotic resistance; which also interfere with the treatment program and increases costs to health care institutions. This article could lead to further epidemiological evaluations in clinical environments, due to the risk associated with opportunistic and antibiotic resistance strains.

Introduction

Seven strains of *Pseudomonas aeruginosa* isolated from hospital environmental surfaces were characterized in order to test their ability to produce biosurfactants, pyocyanin, biofilms and test resistance to different antibiotic and heavy metal concentrations, growth on various carbon sources and antimicrobial resistance.

Hemolytic profile All strains produced mono and dirhamnolipids. Furthermore, they were capable of producing a wide variety of secondary metabolites including pyocyanin and biosurfactants. In addition, they had the ability to form biofilms on various surfaces which confers the strain virulence (Grosso-Becerra, et al., 2014; Ruvalcaba Ledezma, et

al, 2014; Tsiry Rasamiravaka, et al., 2014)

When using the method known as Kirby Bauer, strains showed resistance to antibiotic (ampicillin, amoxicillin, cefotaxime, ceftazidime, amikacin and imipenem). The Minimum Inhibitory Concentration (MIC) was evaluated, showing tolerance to metals in decreasing order ($As^{5+} > As^{3+} > Zn^{2+} > Pb^{2+} > Fe^{3+} > Cd^{2+} > Cu^{2+} > Cr^{6+}$). Study design and *P. aeruginosa* strains.

Materials and Method

An observational descriptive study was conducted in seven strains of *Pseudomonas aeruginosa* which were isolated from hospital environmental surfaces and identified as: H15, H16, H17, H18, H19, H20 and H21. Susceptibility to different antibiotics and heavy metals, biosurfactant and pyocyanin assays, Production of pyocyanin, hydrocarbons growth assay and ability to form biofilms.

Results and Discussion

Seven native strains, identified as *P.*

aeruginosa were isolated from hospital surfaces. All the strains were able to cause hemolysis on blood agar, producing foam in PPGAS broth and showed surface activity by the drop collapse method (see Figure 1A). Only the H15 strain was able to emulsify to 65% toluene, 60% cyclohexane, 55% vegetable oil and 26% diesel, the strain H21 emulsified 15% vegetable oil, the other strains did not show this capability.

The crude extracts showed activity at temperatures of 120°C, at salinity concentration of 10% NaCl, and in the interval of pH measured (2.0 to 11.0). The strains were able to produce biosurfactants. The H15 strain produced 0.8 mg ml⁻¹ of rhamnolipid. All strains produced mono and dirhamnolipids, (Results are shown for the H15, H20 and H21 strains where monorhamnolipid and dirhamnolipids type were detected similar than *P. aeruginosa* PAO1 (see Figure 1B). In addition, all the strains were able to grow on glucose, toluene, cyclohexane, petroleum and diesel as the only carbon source (Toribio Jiménez, et al., 2015).

Fig 1. Tests for biosurfactant production. A) Hemolysis on blood agar. B) Foam production in PPGAS broth. C) Drop collapse, D) Emulsification index (IE₂₄).⁴

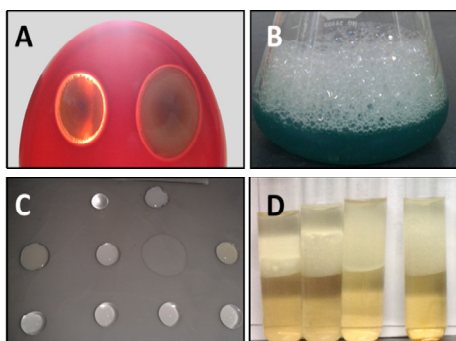
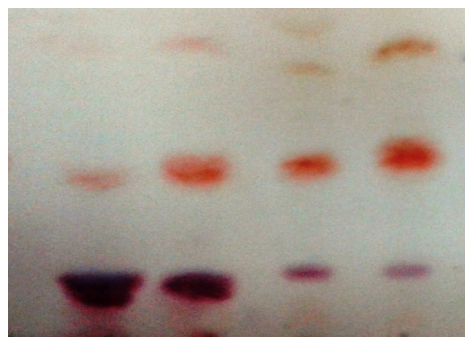


Fig 2. Detection of rhamnolipids by thin layer chromatography (TLC). Up to down: HAAs (Chains of fatty acids); Mono-RhL (Monorhamnolipids); Di-RhL: (Dirhamnolipids). From left to right: Strains PAO-1, H15, H20, H21.⁴



Production of pyocyanin was registered in all strains, with varying concentrations ranging from 1.29, 1.51, 2.87, 2.9, 8.69, 8.9 and 9.56 $\mu\text{g ml}^{-1}$ for strains H20, H21, H16, H17, H19, H18 and H15 respectively. In addition, they were able to form biofilms under the conditions tested. The profile of antibiotic resistance in 100% of the strains showed that those were resistant to ampicillin, amoxicillin and 90% of cefotaxime, 80% to cefotaxime and ceftazidime, and 100% sensitive to amikacin and imipenem respectively.

As it observed in the analysis of MIC to heavy metals and metalloids, changes were observed in all strains of *P. aeruginosa* in colonial morphology in the presence of metal. Most of the colonies were mucoid and were capable of emitting fluorescence in the presence of Pb, Cd and Zn. The same resistance profile $\text{As}^{5+} > \text{As}^{3+} > \text{Zn}^{2+} > \text{Pb}^{2+} > \text{Fe}^{3+} > \text{Cd}^{2+} > \text{Cu}^{2+} > \text{Cr}^{6+}$ ($> 20, 10, 10, 6, 4, 4, 2$ and 2 mmol l^{-1} , respectively) was observed. *Pseudomonas aeruginosa* strains isolated from hospital environmentalis considered as biological indicators of environmental pollution. (Ruvalcaba et al, 2014). In this study, 0.8 mg ml^{-1} was produced by the strain H15, and the types of biosurfactants of both strains were mono and dirhamnolipids (Figure 2) (Toribio Jiménez, et al., 2015).

In conclusion, the presence of virulent microbiological agents resistance to antibiotics, heavy metals and metalloids, produced biosurfactants, pyocyanin, form biofilms in the hospital, may enhance the adverse effects on public health and hospital environmental surroundings, hence the importance, as they impact on human health in the family economy and health care (Toribio Jiménez, et al., 2015). *Pseudomonas aeruginosa* of surfaces hospital environment that presents high

resistance to antibiotics and heavy metals is also meaningful because apart from their presence in the surfaces is considered microbiological indicators of environmental pollution in hospital. Strains formed biofilms and produced pyocyanin. Thus, resistant strains could lead to hospital outbreaks because of antibiotic resistance; which also interfere with the treatment program and increases costs to health care institutions (Toribio Jiménez, et al., 2015). This article could lead to further epidemiological evaluations in clinical environments, due to the potential risk associated with opportunistic and antibiotic resistance strains.

Reference

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