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ORIGINAL ARTICLE

Antimicrobial activity of different sodium and potassium salts of carboxylic acid against some common foodborne pathogens and spoilage-associated bacteria

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Abstract Cleaning and disinfection represent the most important activities associated with the elimination of dirt and microorganisms at food processing plants. Improper procedures may lead to cross contamination of food leading to its spoilage or even the transmission of foodborne pathogens. Several strategies have been used in order to achieve a good disinfection of surfaces and products; nevertheless, microbial resistance to common-use-products has developed lately. Due to this fact, the development of new non-toxic-food compatible chemical agents that reduce the impact of foodborne pathogens and spoilage causing microorganisms is desirable for the food industry. The objective of the present study was to evaluate the antimicrobial activity of different sodium and potassium salts of aliphatic and aromatic carboxylic acid on the growth of common food spoilage and pathogenic microorganisms. Growth curves were determined for *Leuconostoc mesenteroides, Lactobacillus plantarum, Enterococcus faecalis, Candida albicans, Pseudomonas aeruginosa, Salmonella* Enteritidis, and *Listeria monocytogenes* in contact with different concentrations of carboxylic acid salts. The inhibitory effect of both aliphatic and aromatic carboxylic acid salts, in accordance with concentration levels, was 100 > 50 > 25 mg/ml. The inhibitory effect of aliphatic salts was butanoic > hexanoic> octanoic > decanoic and, benzoic > gallic > caffeic acid salts for aromatic salts. In general, sodium salts were more inhibitory than potassium salts ($p \leq 0.05$).

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PALABRAS CLAVE
Actividad antimicrobiana;
Carboxilatos de sodio;
Carboxilatos de potasio;
Patógenos alimentarios;
Deterioro

Actividad antimicrobiana de diferentes sales de ácidos carboxílicos de sodio y potasio contra algunos microorganismos patógenos y de deterioro asociados a alimentos

Resumen La limpieza y la desinfección representan las actividades más importantes asociadas a la eliminación de suciedad y microorganismos de las plantas procesadoras de alimentos. El uso de procedimientos incorrectos puede llevar a la contaminación cruzada de los alimentos y, por ende, al deterioro de estos o a la transmisión de patógenos de origen alimentario. Se han desarrollado varias estrategias con el fin de obtener una buena desinfección de superficies y productos; no obstante, ha aparecido resistencia microbiana frente a productos de uso común. Debido a esto, el desarrollo de agentes químicos no tóxicos capaces de reducir el impacto de patógenos de origen alimentario y microorganismos causantes de deterioro es deseable para la industria alimentaria. El objetivo de este estudio fue evaluar la actividad antimicrobiana de diferentes sales de sodio y potasio de ácidos carboxílicos alifáticos y aromáticos sobre algunos microorganismos patógenos y asociados a deterioro alimentario, analizando su impacto sobre el crecimiento. Se determinaron las curvas de crecimiento de *Leuconostoc mesenteroides, Lactobacillus plantarum, Enterococcus faecalis, Candida albicans, Pseudomonas aeruginosa, Salmonella enteritidis* y *Listeria monocytogenes* en presencia de diferentes concentraciones de las sales de ácidos carboxílicos. El efecto inhibitorio de las sales de ácidos carboxílicos alifáticos y aromáticos, según su nivel de concentración, se ordenó del siguiente modo: 100 mg/ml > 50 mg/ml > 25 mg/ml. El efecto de las sales de ácidos alifáticos siguió el orden butanoico > hexanoico > octanoico > decanoico, en tanto que las de ácidos aromáticos se ordenó del siguiente modo: benzoico > gálico > cafeico. En general, las sales de sodio fueron más inhibitorias que las de potasio ($p \leq 0{,}05$).

Introduction

Cleaning and disinfection represent the most important activities associated with the elimination of dirt and microorganisms at food processing plants. Improper procedures may lead to cross contamination of food leading to its spoilage or even the transmission of foodborne pathogens[4]. Several strategies have been used in order to achieve a good disinfection of surfaces and products; nevertheless, microbial resistance to common-use-products has developed lately, even though microorganisms vary greatly in their resistance to chemical germicides and sterilization processes[7]. Due to this fact, the development of new non-toxic-food compatible chemical agents that reduce the impact of foodborne pathogens and spoilage-causing microorganisms is desirable for the food industry[5,17].

Recently, different researchers have described the inhibitory action of short chain organic acids and/or their salts on the growth of bacteria and molds[25], including pathogens[22,24]. These products are generally recognized as safe (GRAS) compounds frequently used as chemical decontaminants[18].

Acetate, lactate and citrate sodium salts have shown an inhibitory effect on the growth of some food spoilage bacteria and antimicrobial activity against foodborne pathogens, including *Staphylococcus aureus* and *Yersinia enterocolitica*[11], *Listeria monocytogenes*[15], *Escherichia coli*[11,12], as well as *Clostridium botulinum*[1]. Moreover, a limited antimicrobial capacity has been reported for some organic acid salts against lactic acid bacteria during meat spoilage[6,14].

Because of the association of salt consumption with the risk of hypertension, health promoters advise a lower intake of this compound; nevertheless, there has been controversy regarding the effect of salt removal or reduction on the shelf life and safety of food products. Potassium salt intake is actually promoted by the World Health Organization (WHO), and the new guidelines advise adults to consume less than 5 g of salt and at least 3.510 mg of potassium per day in order to reduce the risk of high blood pressure[23].

Potassium salts have also been tested for their antimicrobial effect. Some researchers have described inhibitory effects on pathogenic bacteria, including *L. monocytogenes*, *Vibrio parahaemolyticus* and *Clostridium perfringens*[1]; nevertheless, there is still controversy over the subject.

The objective of the present study was to evaluate the inhibitory effect of different sodium and potassium organic salts on the growth of common food spoilage and pathogenic microorganisms including *Leuconostoc mesenteroides, Lactobacillus plantarum, Enterococcus faecalis, Candida albicans, Pseudomonas aeruginosa, Salmonella* Enteritidis and *L. monocytogenes*.

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