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Pathways of Alpha Synuclein in Inflammation

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Introduction

The current study looks at the antimicrobial potential of non-equilibrium plasma against microorganisms isolated from diatomaceous earth, a byproduct of the beer filtration process. Waste diatomaceous earth from an industrial brewery was treated with non-equilibrium plasma in a glidearc reactor for testing. The temperature of the treated samples was kept track of microscopically, the effect of plasma on the morphology of the treated material was investigated. Plasma can change the physicochemical properties of the treated material in a variety of ways. As a result, the range of potential plasma applications is constantly broadening, from material technologies to decontamination applications in the food industry, environmental protection, and medicine, and it stimulates activities in areas such as agriculture and medicine [1].

Description

The use of diatomaceous earth in beer filtration is regarded as one of the fifty most significant technological advances in brewing history. This is due to diatomaceous earth's unique porosity and high adsorption capacity, as well as its low density. As a result, high beer clarity can be achieved with relatively low auxiliary material costs. Lager beer is clear after proper cold conditioning; however, filtration is required to ensure a higher level of clarity and stability. Diatomaceous earth deposits were formed primarily in the United States and China by the deposition of ancient marine algae. It is estimated that approximately two-thirds of its total extraction is used for beverage (primarily beer) filtration [2].

To make clear beer, use 1 to 2 g of this rock per litre of clear product. However, after the filtration stage, the mass of spent diatomaceous earth is significantly greater than the original mass. This is because some of the water and other organic components are retained on the filter barrier. The amount of spent diatomaceous earth with sludge generated annually by a medium-sized brewery is approximately 100 tonnes. As a result, it, along with spent grains, residual yeasts, and trub, constitutes the majority of brewing waste. Its consumption could be reduced by using other, often more expensive, filtration materials or by encouraging the consumption of cloudy, unfiltered beer.

The environmental consequences of producing such large amounts of spent diatomaceous earth are currently unknown. The majority of the diatomaceous earth that was used for filtration is still stored or used as fertiliser. One of the current priorities for food production plants is to reduce generated waste and find alternative ways to manage it. Furthermore, some scientific institutions are working to develop new applications for diatomaceous earth. Preliminary research into the use of diatomaceous earth in the production of cost-effective biosorbents, storage pest control agents, brick production, and silver nanocomposites appears to be promising. The numerous applications of plasma stem from the fact that numerous active agents are generated during its operation, which can affect the treated material in a variety of ways.

As a result, the scope of potential plasma applications in material technologies is constantly expanding: from cleaning and simple changes in wettability and surface micro-roughness to chemical and structural modifications, layer removal or deposition, and the formation of anti-corrosion coatings or coatings with other specific properties that protect against gas diffusion, high temperatures, and excessive wear.Other potential applications are based on plasma's strong antimicrobial effect, as it generates reactive oxygen and nitrogen forms such as hydrogen peroxide, OH, OH2, NO, O3 radicals, and so on. UV radiation, which is generated during plasma treatment, is an important additional antimicrobial factor. Plasma has a multi-stage effect on microorganisms. The most common are irreversible cell wall damage, cytoplasmic membrane disruption, and cell death [3].

Non-equilibrium plasma treatment causes several types of stress in yeast cells, primarily due to the presence of free radicals reacting with yeast cellular components such as proteins, enzymes, genetic material, and lipids. The type of disorder caused by plasma in yeast cells impairs basic functions, causes physiological and biochemical disturbances, and eventually leads to death. As a result, while the goal of the current study was to quantitatively assess the antimicrobial properties of non-equilibrium plasma, having obtained promising results in this regard, it was reasonable, as a next step, to deepen the analysis towards characterization of the mechanisms underlying this process. This comprehensive procedure will allow us to determine the most optimal conditions for plasma treatment of diatomaceous earth and, ultimately, to approximate the obtained results to other microbiologically contaminated porous materials [4,5].

Conclusion

The findings support the use of non-equilibrium plasma generated in a glide arc reactor for decontamination of microorganisms colonising diatomaceous earth after the beer filtration process. Other than drying due to the flow of working gas, analysis of the material's porous surface with an optical microscope at 800 magnification revealed no destruction of the material as a result of plasma treatment. Furthermore, the obtained FTIR spectra show no change in the chemical composition of the material across all treatment times. Microbiological tests revealed the presence of three types of bacteria and three types of yeasts in the tested material, all of which are associated with beer production. For the shortest time porous material, the effect of plasma treatment on reducing the number of listed organisms is already visible.

Acknowledgement

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Conflict of Interest

None.

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