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The effect of composition on mechanical properties of biodegradable plastic based on chitosan/cassava starch/PVA/crude glycerol: Optimization of the composition using Box Behnken Design

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Abstract

Synthetic plastic waste is one of the most concerning problems on our earth today. For that reason, many researchers are currently developing biodegradable plastics as a substitute for synthetic plastics for food packaging purposes. However, biodegradable plastics have poor mechanical properties because of their characterteristics as biopolymers, such as brittle and fragile. Chitosan has often been used as an additive in starch or PVA mixtures because of its biodegradability. Meanwhile, PVA itself is widely used in polymer blends because it can increase the flexibility and tensile strength of

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Volume 63, Supplement 1,
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Response surface methodology for synthesis of bio-jet fuel from waste cooking oil using agitated ozone treatment

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Materials Today: Proceedings

Volume 63, Supplement 1, 2022, Pages S78-S83

The effect of composition on mechanical properties of biodegradable plastic based on chitosan/cassava starch/PVA/crude glycerol: Optimization of the composition using Box Behnken Design

Shalahudin Nur Ayyubi [a], Aprilina Purbasari [a], Kusmiyati [b]

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Abstract

Synthetic plastic waste is one of the most concerning problems on our earth today. For that reason, many researchers are currently developing biodegradable plastics as a substitute for synthetic plastics for food packaging purposes. However, biodegradable plastics have poor mechanical properties because of their characterteristics as biopolymers, such as brittle and fragile. Chitosan has often been used as an additive in starch or PVA mixtures because of its biodegradability. Meanwhile, PVA itself is widely used in polymer blends because it can increase the flexibility and tensile strength of biodegradable plastic. The aim of this study is to develop a biodegradable plastic based on chitosan, cassava starch, and PVA with the addition of crude glycerol as a plasticizer. Observation of the effect of chitosan, starch, and PVA content on the mechanical properties of chitosan/cassava starch/PVA biodegradable plastics were carried out using Design-Expert Version 10.0.1 with Response Surface Methodology-Box Behnken Design. The composition of chitosan, starch, and PVA was varied from the range of 1–3 g, 1–5 g, and 1–5 g respectively. The optimization results suggest that biodegradable plastic with the composition of 3 g chitosan, 1 g starch, and 5 g PVA has the highest tensile strength and elongation values. The optimum biodegradable plastic showed that it was degraded by 50.45% of its weight after being buried in the soil for 30 days. Furthermore, the optimum biodegradable plastic can be investigated for its characteristics in further research.

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Keywords

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Application of feed forward neural network for fouling thickness estimation in low density polyethylene tubular reactor

Fakhrony Sholahudin Rohman [a, b], Dinie Muhammad [a], Sudibyo [c], Muhammad Nazri Murat [a], Ashraf Azmi [d]

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Abstract

In this research, the Feed Forward Neural Network (FFNN) development using Levenberg-Marquardt training method for estimation of fouling thickness layer in Low density polyethylene tubular (LDPE) reactor is performed. The highly exothermic nature of the LDPE polymerization process and the heating-cooling prerequisite in the tubular reactor can create fouling problems. Thus, the FFNN modeling technique has been applied to predict the fouling thickness of LDPE in the cooling zone of the polymerization tubular reactor. The fouling formation on the inner wall in the cooling zone is rarely reported in previous related LDPE studies since it is difficult to measure. The fouling thickness layer might increase to an unsafe level if it is not monitored. In addition, the fouling layer has a low thermal conductivity which increases the resistance to heat transfer and reduces the effectiveness of heat exchangers. In order to develop the FFNN model, a set of fouling data is generated from the combination of LDPE tubular reactor model simulation using Aspen Dynamic and fouling build-up equation. In order to improve the FFNN model input selection, the Pearson correlation coefficient (PCC) method is implemented. Based on PCC analysis, polymer density, heat transfer coefficient, and reactor temperature in the respective cooling zone were considered as inputs for the developed FFNN model. The variation of the hidden node was evaluated to assess the accuracy of the model based on the coefficient of determination (R^2) value. Based on the FFNN modeling results, the highest accuracy to predict fouling thickness was achieved using eight hidden nodes with 0.983 R^2.

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Keywords

Low density polyethylene; Tubular reactor; Fouling; Neural Network; Polymerization

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Materials Today: Proceedings

Volume 63, Supplement 1, 2022, Pages S346-S348

Response surface methodology for synthesis of bio-jet fuel from waste cooking oil using agitated ozone treatment

Anggun Puspitarini Siswanto [a], Mohamad Endy Yulianto [a], Dwi Handayani [a], Mirza Muhammad Faisal [a], Oktaviani Kusuma Wardani [a], Dmitriy Kuvshinov [b]

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Abstract

Development of bio-jet fuel has gained much attention in the few years due to the carbon emission problem. Waste cooking oil (WCO) is an alternative raw material to produce medium chain of methyl ester which has similar properties with bio jet fuel. This research aims to investigate the Response Surface Methodology for synthesis of bio-jet fuel from waste cooking oil using agitated ozone treatment. In this study, bio jet fuel was produced using ozonolysis method with agitated ozone generator. The effect of reaction time, ozonolysis concentration and ozonolysis flow rate were optimized using response surface methodology (RSM) based on a central composite design (CCD). The optimum conditions obtained from RSM were 3% of ozonolysis concentration, 10 L/min of ozonolysis flow rate and 10 min of reaction time. Under this condition, the properties of bio-jet fuel met with the commercial standard of bio-jet fuel which are the density and %FFA conversation were 0.863 g/mL and 2.95%, respectively.

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Keywords

Bio jet fuel; Cooking oil; Ozone treatment; RSM

1. Introduction

ScienceDirect

Materials Today: Proceedings

Volume 63, Supplement 1, 2022, Pages S273-S275

Effect of Reynolds number on pressure behavior of slider contact with triangular dimple considering slip

Imam Syafaat [a], Muhammad Nurkhafidin [a], Muchammad Muchammad [b], Mohammad Tauviqirrahman [b], Budi Setiyana [b, c]

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Abstract

One of the engine components used to reduce friction between two rotating machine elements is the bearing. Currently, studies on the provision of surface roughness on the bearing surface are being conducted to improve its performance. Simplification of surface roughness texture is modeled with various dimple shapes. There is still a paucity of literature dealing with the Reynolds equation in the context of slip and cavitation. This work proposes to utilize numerical analysis to examine the pressure induced by differences in the shape of the dimple. The dimple is portrayed as a triangle with two distinct forms. When approaching the present reality, cavitation is taken into account. Lubricating fluid enters through the dimple on the inlet side and departs through the outlet channel. Slippage is also a factor in computational fluid dynamics simulation. The pressure behavior is determined by varying the Reynolds number. The results show that the higher the Reynolds number, the more pressure is generated. The pressure produced by the triangular dimple shape with high sides at the outlet is greater than the pressure formed by the high-textured dimple at the inlet. The slippage has an impact of 17% on pressure enhancement.

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Keywords

Triangular dimple; Slip; Slider bearing

ScienceDirect

Materials Today: Proceedings

Volume 63, Supplement 1, 2022, Pages S368-S372

An overview of dietary isoflavones on bone health: The association between calcium bioavailability and gut microbiota modulation

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Abstract

Osteoporosis is the most common cause of morbidity and economic burden globally. Osteoporosis treatment and management may be lacking in current methods. Isoflavones are considered potential alternatives to bone loss and osteoporosis therapy. This review aimed to describe the effect of dietary isoflavones on bone health. The association of calcium bioavailability and gut microbiota was discussed in this paper. Daidzein, genistein, and their metabolites, namely equol, are essential isoflavones in bone formation. Isoflavones play a role in calcium homeostasis during the calcium uptake process by mobilizing bone calcium into the circulation. Isoflavones and equol increase bone mineral density in the gastrointestinal tract by stimulating bone formation. However, despite the fact that isoflavones promote bone health by regulating the bioavailability of calcium and gut microbiota, conflicting results have defined their effects. Therefore, further research on the effects of isoflavones on bone health is still required to confirm the link between calcium bioavailability and gut microbiota.

Previous Next

Keywords

Isoflavones; Calcium bioavailability; Gut microbiota; Bone health; Osteoporosis

1. Introduction

Osteoporosis, a disease characterized by bone fragility, is responsible for most morbidity and economic burden around the world. Osteoporosis is more common in adults, and it can also strike children and adolescents, whose bone mass is higher than that of women [1]. A significant increase in bone loss occurs in the later stages of menopause and early postmenopause [2]. Factually, bone mass in early life is the most important modifiable determinant of lifelong skeletal