可降解地膜原料大豆秸秆纤维的制备工艺及参数优化

Preparation technology and parameters optimization for soybean straw fiber as biodegradable film material

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中文摘要：

为了解决秸秆和塑料地膜带来的环境污染问题，高值化利用秸秆资源。该研究采用二次正交旋转中心组合试验方法，探索运用物理方法制取清洁、高强度、高得率的可生物降解地膜原料-大豆秸秆纤维的可行性，寻求物料特性和工作参数对制取大豆秸秆纤维的影响规律和最优工艺参数组合。分别选取大豆秸秆长度、浸泡时间、加工温度、主轴转速和喂入量为影响因素，纤维得率、纤维长宽比及抗张强度为响应函数，应用Design-expert 6.0.10软件设计方案与数据分析。试验结果表明：当参数组合为秸秆长度7 cm、浸泡时间24 h、喂入量27 g/min、工作温度80～85℃、转速110～120 r/min时，制得的大豆秸秆纤维得率大于80%、干抗张强度大于7 N、长宽比大于5；各因素对纤维得率贡献率的主次关系为：浸泡时间>主轴转速>喂入量>秸秆长度>加工温度，各因素对干抗张强度贡献率的主次关系为：秸秆长度>加工温度>喂入量>浸泡时间>主轴转速，各因素对纤维长宽比贡献率的主次关系为：喂入量>秸秆长度>加工温度>浸泡时间>主轴转速。为利用大豆秸秆制备可降解地膜提供理论依据和技术支撑。

英文摘要：

In order to solve the problem of environmental pollution caused by straw burning and plastic film, straw resources should be utilized with high value. The method of the central composite rotatable quadratic orthogonal experimental design was applied to explore the possibility for preparing soybean straw fiber as clean, high strength and high yield raw material for biodegradable film with physical method. The effects of material characteristics and operating parameters on soybean straw fiber properties and optimal parameters combination were studied. Soybean stalk length, soak time, operation temperature, spindle speed and feeding rate were selected as influence factors. Fiber yield, fiber aspect ratio and tensile strength were selected as response functions. The Design-expert 6.0.10 software was applied to design the scheme and analyze the data. The results showed that 1) with the parameters of straw length 7 cm, soaking time 24 h, feeding rate 27 g/min, operation temperature 80~85℃ and spindle speed 110~120 r/min, the fiber yield was over 80%, dry tensile strength was over 7 N, aspect ratio was over 5. 2) The order of contribution rate of all the factors on fiber yield was: soak time>spindle speed>feed rate>stalk length> operation temperature; The order of contribution rate of all the factors on tensile strength was: stalk length> operation temperature> feed rate>soak time>spindle speed; The order of contribution rate of all the factors on fiber aspect ratio was: feeding rate>stalk length>operation temperature>soak time>spindle speed. The research can provide a theoretical and technical support for manufacturing biodegradable film with soybean straw.

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