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基于固沙效果的玉米芯液化工艺优化及固化机理

Optimization and micro-mechanism of liquefied corncob for sand stabilization

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中文关键词: 液化 风洞 固沙 玉米芯 起沙风速

英文关键词: liquefaction wind tunnels sand consolidation corncob threshold wind velocity

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中文摘要:

为优化玉米芯液化工艺，从而改善液化产物的固沙效果，采用四因子二次正交旋转试验设计，研究了液化温度、液化时间、固液比、催化剂质量分数对玉米芯液化产物固沙后起沙风速的影响。通过回归分析和响应面分析，建立并分析了4个因子对起沙风速影响的数学模型，且所得回归方程显著，拟合情况良好。当玉米芯液化产物的喷施量为167 g/m2时，其用于固沙的最优液化工艺为：液化温度为125℃，液化时间为29 min，固液比为30%，催化剂质量分数为2.8%，在该条件下得到最大的起沙风速为20.18 m/s。采用扫描电子显微镜和红外光谱仪对玉米芯液化产物处理沙土前后的固结层进行了测试，发现玉米芯液化产物主要通过物理胶黏作用增加沙粒的抗风蚀性能。

英文摘要:

In order to optimize the liquefaction process of corncob and improve the sand stabilization effect of liquefied corncob, the guadra-rotation orthogonal experiment with four factors was employed. The effects of the liquefaction temperature, liquefaction time, corncob content and catalyst content on the threshold wind velocity of liquefied corncob was studied. Functional model between the threshold wind velocity and the four factors were proved to be significantly correlated. The mathematical model was established and analyzed by regression method. When the spraying quantity of liquefied corncob on sand was167g/m2, the optimal liquefaction effect of corncob, accordingly, the largest threshold wind velocity of 20.18 m/s was obtained under the condition that the liquefaction temperature was 125 ° C. The liquefaction duration was 29 min and the corncob content and catalyst content were 30% and 2.8%, respectively. The sand crusts fixed with different amounts of liquefied products were analyzed using Fourier transform infrared radiometer (FTIR) and scanning electron microscopy (SEM). The results revealed that the application of liquefied corncob enhanced the sand cementation so as to improve its resistance capability to wind erosion.

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