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野生观赏植物长药八宝对石油烃污染土壤的修复研究

### Phytoremediation of petroleum hydrocarbon contaminated soils using a wild ornamental plant *Hylotelephium spectabile* (Boreau) H. Ohba

关键词: [植物修复](#) [长药八宝](#) [石油烃](#) [野生观赏植物](#) [污染土壤](#)

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摘要: 植物修复作为一项绿色修复技术, 是石油烃污染土壤有效而可行的修复方法之一.野生观赏植物应用于植物修复, 不仅能展现野生植物的良好耐性, 在治理污染的同时美化环境, 还能发挥观赏植物的特性, 避免将污染带入食物链.本研究通过温室盆栽试验探讨了野生观赏植物长药八宝 (*Hylotelephium spectabile* (Boreau) H. Ohba) 对大港油田石油烃污染土壤的修复潜力.结果表明: 长药八宝对石油烃污染的盐碱土具备良好的耐性, 虽然长药八宝的地上部生物量相对于对照组有所降低, 但与修复活动更为相关的根部生物量并未受到明显抑制, 长药八宝也未表现出明显的毒害症状; 长药八宝对石油烃污染土壤的修复效果比较显著, 当土壤石油烃浓度为 $11874 \text{ mg} \cdot \text{kg}^{-1}$ 、 $20075 \text{ mg} \cdot \text{kg}^{-1}$ 和 $38986 \text{ mg} \cdot \text{kg}^{-1}$ 时, 其降解率分别为47.99%、24.49%和22.98%, 明显高于空白对照组的降解率(仅为32.37%、21.57%和17.64%) ( $p < 0.01$ ); 通过最大或然数法(most probable number, MPN)观测到 $11874 \text{ mg} \cdot \text{kg}^{-1}$ 、 $20075 \text{ mg} \cdot \text{kg}^{-1}$ 和 $38986 \text{ mg} \cdot \text{kg}^{-1}$ 浓度的石油烃污染胁迫下, 烷烃和芳烃降解菌的数量都要高于空白对照组, 这在一定程度上促进了根际微生物对石油烃的降解.总之, 长药八宝对一定浓度的石油烃污染盐碱土具备良好的耐性, 对土壤中石油烃污染具备较高的降解率, 具备修复总石油烃浓度在 $40000 \text{ mg} \cdot \text{kg}^{-1}$ 以下的石油烃污染盐碱土的能力.

**Abstract.** As a type of green remediation technology, phytoremediation is an effective and feasible method for cleanup of petroleum hydrocarbons (PHCs) in contaminated soils. Wild ornamental plants subjected to phytoremediation not only beautify our environment through their ornamental characteristics, but also avoid introducing contaminants into the food chain on the basis of their good endurance. In this study, we performed a greenhouse pot-culture experiment to investigate the potential of a special ornamental plant *Hylotelephium spectabile* (Boreau) H. Ohba. in remedying PHCs-contaminated saline-alkali soils from the Dagang Oilfield in Tianjin, China. The results showed that *H. spectabile* had good endurance to PHCs. Although the shoot biomass decreased, the root biomass closely related to PHCs degradation was inhibited insignificantly. There were no obvious adverse symptoms on *H. spectabile* by the press of PHCs. The degradation rate of total petroleum hydrocarbons (TPHs) with  $11,874 \text{ mg} \cdot \text{kg}^{-1}$ ,  $20,075 \text{ mg} \cdot \text{kg}^{-1}$  and  $38,986 \text{ mg} \cdot \text{kg}^{-1}$  of TPHs in soils by *H. spectabile* was 47.99%, 24.49% and 22.98%, respectively, much higher than those in the corresponding controls (32.37%, 21.57% and 17.64%, respectively) ( $p < 0.01$ ). The number of culturable petroleum degraders was counted by the most probable number (MPN) method. The petroleum degraders greatly increased in the phytoremediation treatments, promoting the degradation of PHCs. In conclusion, *H. spectabile* might be an enduring wild ornamental plant for effective phytoremediation of saline-alkali soils contaminated with  $\leq 40000 \text{ mg} \cdot \text{kg}^{-1}$  of PHCs.

**Key words:** [phytoremediation](#) [Hylotelephium spectabile](#) (Boreau) H. Ohba [petroleum hydrocarbon](#) [ornamental plant](#) [contaminated soil](#)

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