

生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	細胞結構吸收並儲存污染物 (Cell structures absorb and store pollutants)
生物系統 LIVING SYSTEM	義大利黑麥草 <i>Festuca perennis</i> (Italian rye-grass)
功能類別 FUNCTIONS	#獲取、吸收、或過濾化學物質 #Capture, absorb, or filter chemical entities
作用機制標題	黑麥草細胞中的非極性區域透過從根部吸收有毒工業污染物，並分散到細胞壁和隔離的液胞中，將它們大量地從環境中移除 (Non-polar regions of cells in Ryegrass remove relatively large quantities of toxic, oily industrial pollutants from the environment by absorbing them through roots and distributing them in cell walls and sequestered vacuoles.)
生物系統/作用機制 示意圖	
作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)	
<p>化石燃料 (fossil fuel) 的不完全燃燒，如天然氣和煤炭，產生了難以分解的有毒、油性物質，並逐漸累積在環境中。這些污染物被稱為多環芳香烴 (polycyclic aromatic hydrocarbon, PAH)，其中很多為致癌性 (carcinogenic) 或致突變性 (mutagenic)。要從土壤中清除這些污染物相當困難且昂貴。但某些植物，例如黑麥草 (ryegrass)，卻能被动地從土壤中吸收 PAHs，並儲存在植物可將這些油性物質溶解的區域，例如細胞壁和液胞。將水吸收至根部 (pull water through roots) 的相同低耗能方式，也有助於將 PAHs 帶入植物組織中。</p> <p>The incomplete burning of fossil fuels, such as gas and coal, leads to the creation of toxic, oily substances that are hard to break down and accumulate in the environment. These pollutants are known as polycyclic aromatic hydrocarbons (PAH) some of which are carcinogenic or mutagenic. Ridding soils of these pollutants can be difficult and expensive. But certain plants, such as ryegrass, passively sip PAHs out of the soil and store them in areas of the plant where oily substances can dissolve, such as cell walls and vacuoles. The same low-energy processes that pull water through the roots also help to pull PAHs into plant tissues.</p>	

文獻引用 (REFERENCES)

「PAHs 是一群在環境中普遍存在 (ubiquitous) 且不易分解的持續性有機污染物 (persistent organic contaminants, POP)。它們的毒性 (例如致突變性、致癌性) 和可能累積在生物體中的潛在危害引起了關注...環境中 PAH 的主要來源包括有機殘留物的不完全燃燒、石油生產 [和] 火山爆發。」 (Kang et al. 2010: 1)

「植物根部由水和土壤吸收物質的方式是 PAH 進入植物體的主要途徑...PAHs 首先吸附到根的表面，然後穿透相鄰的細胞膜，再堆積在細胞壁和液泡中。PAHs 的吸收量主要取決於植物根部的脂質含量，那些包括蛋白質、脂肪、核酸、纖維組織和其他成分等都含有親脂性成分，使它們都可能是 PAHs 穿透植物根細胞後進行累積的主要區域。」 (Kang et al. 2010: 2)

「細胞內組成分的脂質含量決定了親脂性化合物累積的程度，而擴散速率則是與細胞壁和細胞內胞器之間建立的濃度梯度有關。」 (Kang et al. 2010: 5)

“Polycyclic aromatic hydrocarbons (PAHs) are a group of persistent organic contaminants (POPs) that are ubiquitous in the environment. Their toxicity (e.g., mutagenic, carcinogenic) and potential of accumulation in biota have led to concern...The major sources of PAHs in the environment include incomplete combustion of organic residues..., petroleum production, [and] volcanic eruptions.” (Kang et al. 2010: 1)

“Uptake from water and soil via plant roots is a major pathway of PAH entry into plants...PAHs first adsorbed to root surfaces and then passed through the membranes of adjoining cells before accumulating in cell walls and vacuoles. The amount of uptake depended primarily on the lipid content of plant roots, in which protein, fats, nucleic acids, cellulose tissues, and other components all contain lipophilic components, which appear to be the primary domains where PAHs accumulate once they penetrate plant root cells.” (Kang et al. 2010: 2)

“The lipid contents of intracellular components determine the extent of lipophilic compound accumulation, and the diffusion rate is related to the concentration gradient established between cell walls and organelles inside cells.” (Kang et al. 2010: 5)

參考文獻清單與連結 (REFERENCE LIST)

Kang, F., D. Chen, Y. Gao, and Y. Zhang. (2012). Distribution of polycyclic aromatic hydrocarbons in subcellular root tissues of ryegrass (*Lolium multiflorum* Lam.). *BMC Plant Biology* 10: 210. (<https://link.springer.com/article/10.1186/1471-2229-10-210>)

延伸閱讀

生物系統延伸資訊連結 (LEARN MORE ABOUT THE LIVING SYSTEM/S)

https://en.wikipedia.org/wiki/Festuca_perennis

撰寫/翻譯/編修者與日期

顏子傑翻譯 (2018/10/16)；譚國銜編修 (2021/03/31)；許秋容編修 (2021/05/17)

AskNature 原文連結

<https://asknature.org/strategy/cell-structures-absorb-and-store-pollutants/>