

镉、铅污染对板蓝根生长和品质的影响及其调控

论文标题:镉、铅污染对板蓝根生长和品质的影响及其调控

Impacts of Radix Isatidis of Growth, Quality under Cadmium, Lead Contamination and Control

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radix isatidis;; heavy metal;; growth;; quality;; amendments

我国是世界上中药材生产大国,但由于中药材生产基地环境受到污染,尤其是废旧矿区改造的中药材生产基地严重受到重金属的污染,导致我国生产的中药材重金属超标,但由于不同中药材品种对重金属的吸收情况存在差异,中药材体内重金属含量也有所不同,部分中药材重金属含量超过了《药用植物及制剂进出口绿色行业标准》,其中检测到重金属有Cd、Cu、Pb、Hg、As等。本文在大量查阅文献的基础上利用盆栽试验对常用中药材板蓝根进行了以下试验:(1)重金属镉、铅对板蓝根萌发的影响;(2)镉、铅Cd、Pb污染对板蓝根生长的影响;(3)施加改良剂后镉、铅污染对板蓝根生长的影响。在重金属Cd、Pb对板蓝根萌发的影响试验结果发现镉、铅污染对板蓝根种子萌发有不同程度的抑制作用。低浓度镉(5mg·L⁻¹)对板蓝根的发芽率、发芽指数、发芽势有刺激作用,比对照略高,但随着镉浓度的升高呈现降低趋势。铅胁迫下使板蓝根的发芽率,发芽指数,发芽势都会受到抑制,其程度取决于铅的浓度。同时镉、铅处理对板蓝根根的伸长都有抑制效应。镉、铅污染使种子发芽时的SOD、CAT、蛋白质变化趋向一致,镉、铅处理的最高浓度时酶的活性明显低于对照。在Cd、Pb污染对板蓝根生长的影响试验中发现:镉、铅对板蓝根的生物量影响不同。低浓度的镉能促进板蓝根的生长,其生物量略高于对照,高浓度镉使板蓝根生物量与对照相比下降很多。重金属铅的污染降低了板蓝根生物量。当铅处理达到最大浓度时,可使生物量下降40%。重金属镉、铅胁迫将引起植物体内活性氧自由基剧增,使根系代谢酶活性降低。不同重金属镉、铅水平处理下板蓝根叶子和根对重金属的吸收不同。镉处理下板蓝根叶子对镉的吸收(除镉0.3 mg·kg⁻¹外)显著超过根。铅处理下叶子对铅的吸收(除500mg·kg⁻¹外)低于根对吸收。板蓝根的根和叶片中重金属含量与土壤中重金属有效态含量呈正相关。施加改良剂后镉、铅污染对板蓝根生长影响的试验结果发现:改良剂的应用不同程度的提高了板蓝根的生物量,抑制了重金属的吸收,促进了板蓝根的生长,降低了板蓝根对重金属镉、铅吸收。在镉污染土壤上施加五种改良剂,促进了板蓝根生长,使板蓝根的株高和生物量与对照相比都有不同程度的提高。它们的改良效果依次是凹凸棒土>硅肥>钙镁磷肥>柠檬酸>苹果酸,其中凹凸棒土改良效果最好,显著高于对照,尤其是生物量高于对照12.02g。对于铅而言五种改良剂的改良效果与镉相比有所不同。它们改良顺序为硅肥>凹凸棒土>钙镁磷肥>柠檬酸>苹果酸。不同处理对土壤镉、铅形态变化的影响均表现为降低了镉、铅的交换态,增加了碳酸盐结合态。由于目前有关重金属对中药材影响的研究很少,如何施用改良剂来降低重金属对中药材危害的研究目前尚未见报道,笔者是根据在重金属污染的土壤上施加改良剂减轻粮食蔬菜作物的危害的原理来进行上述试验,因此还不完善,需要在此基础上更加深入的研究,如改变土壤中重金属浓度的大小,改良剂用量等将如何影响板蓝根生长及品质还有待于我们继续研究。

Chinese traditional medicinal crops are well-known in the world. Unfortunately, they were contaminated by heavy metal due to production places polluted by heavy metal. Heavy metal absorbing abilities varied with various species of Chinese traditional medicinal crops, which contributes to different the contents of heavy metals in these crops. As a result, the contents of heavy metals were up to "Green Trade Standards of Importing & Exporting Medicinal Plants & Preparations" and cadmium (Cd), copper (Cu), lead (Pb), mercury (Hg) and arsenic (As) were detected in some Chinese traditional medicinal crops. Four treatments were carried out based on studying documents and pot experiment: (1) Effect of Cd and Pb on radix isatidis germination (2) Effect of Cd and Pb on radix isatidis seeding (3) Effect of Cd and Pb on radix isatidis growth (4) Effect of Cd and Pb on radix isatidis growth after adding modifiers into soils. Effect of Cd and Pb on radix isatidis germination shows radix isatidis germination contaminated are restrained by cadmium or lead to some extent. Low cadmium concentration (5mg ?l⁻¹) hastened germination rate, germination index and germination vigor of radix isatidis which are higher than CK. Further, they tend to decrease with increasing cadmium concentration. In contrast, the corresponding indexes are restrained by lead. Also, root length of radix isatidis are restrained by cadmium and lead. Activity of enzyme with maximal concentration of Cd and Pb are higher than CK. Effect of Cd and Pb on radix isatidis growth shows biomass of radix isatidis is affected by Cd or Pb. Low Cd can promote the growth of radix isatidis and biomass are higher than ck with and inverse relationship to high Cd. Under maximal lead content, radix isatidis biomass greatly reduces to 40%. Contaminated by Cd or Pb, active oxygen free radical sharply increase which reduces the activityof root enzyme metabolism. Contents of heavy metal in leaf are different from those in the root of radix isatidis when they are polluted by Cd or Pb, which shows that Cd and Pb contents in the leaf are higher than in the root of radix isatidis and Pb content in the leaf is lower than in the root of radix isatidis. Contents of heavy metal in the leaf and root of radix isatidis are related to available contents of heavy meals in the soil. Effect of Cd and Pb on radix isatidis growth after using modifier shows the application of modifier can increase biomass of radix isatidis and restrain heavy metal content in the radix isatidis. The application of five kinds of modifiers can promote radix isatidis growth in the soils polluted by Cd. In other word, plant height and biomass of radix isatidis are higher than ck. Their amended effect ranks in the following order: attapulgite > silica fertilizer > Calcium magnesium phosphate > malic acid > citric acid. Among of them, attapulgite is the best, which is higher than ck and biomass is 12.02g more than ck. Different from that of Cd, amended effect of Pb ranks in the order: silica fertilizer > attapulgite > Calcium magnesium phosphate > malic acid > citric acid. Impact of different treatments on the form of Cd or Pb shows that the exchangeable Cd and Pb are decreased and carbonate combined Cd and Pb are increased. At present, there are few researches on effect of heavy metals on Chinese traditional medical crops. Also, the report that amendments is used for the lessen of the effect of heavy metals on Chinese traditional medical crops is seldom seen. The study is conducted based on the principle of the application of amendments in crop and vegetable soils to reduce the impact of heavy metals on them. Therefore, further work is still on the way. For instance, the study on how the using of amendments reduce heavy metal in the soils and how its effect on radix isatidis growth should be done when using different levels of amendments.

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