

Measuring device with ion-exchange resin and measuring method thereof

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(一)Introduction

The phenomenon of contaminated farm lands polluted by different and cumulative sources of heavy metals can't continuously change for the better for a long time because of unlocking polluters. It's difficult to prevent the pollution emissions illegally due to the characteristics of pollution incidents including random time, instant, high concentrations with heavy metals and wide range of locations(張尊國 · 2015). Finally, establishing effective monitoring method with low cost and rapid analysis for tracking pollution is indeed imperative to be one of the environmental fingerprint recognitions and also provided the official inspector with specific areas of the pollution emissions illegally under the limited resource examiner for polluted emissions in the government departments.

(二)Design Concept

Due to environmental factors affect the operating conditions difficult to control, there are no similar facilities as monitoring of environmental quality tools. Monitoring bags with resin as a substrate made (called as "Resin Lapse Recording Capsule", RLRC) as shown in Figure 1, which were extensively spread in the monitoring areas to take down the evidence of the illegal pollution emissions via the use of an ion exchange resin adsorption of heavy metals powerful capability during the monitoring period. All sewage acts are effectively mastered through the use of X-ray fluorescence spectro-meter for rapid detection of resin contained in the concentration of the target elements and the correlation analysis of spatial location. The advantages of RLRC were monitoring costly, high efficiency and rapid analysis etc. in the monitoring system. In addition, the recording pollution emissions of RLRC were practically more sensitive and confirmative than theirs sediments. For the pollution emission behavior secretly at night, holidays or intermittent time, RLRC assorting with the spatial correlative analysis in GIS can grasp or lock the specific polluter that might help the victims achieve the compensation in law.

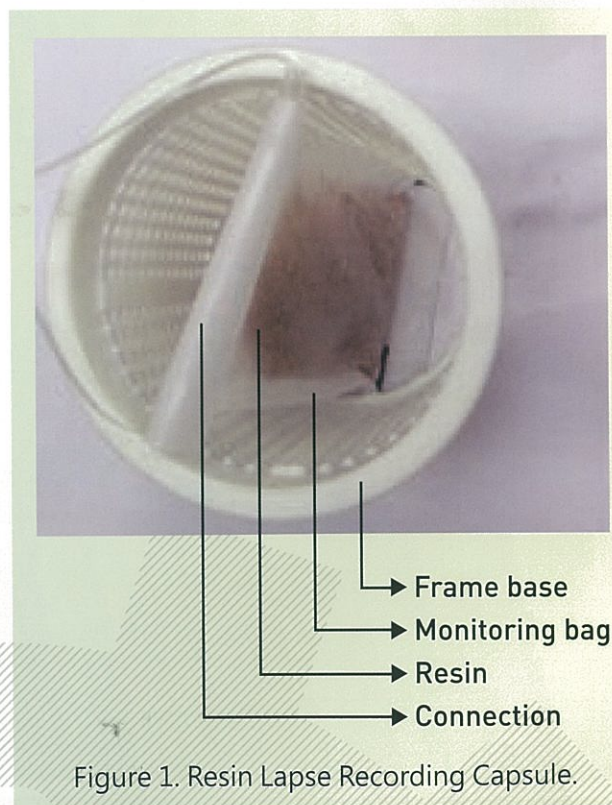


Figure 1. Resin Lapse Recording Capsule.

(三) Technical Development

Ion exchange for heavy metal ions with good exchange properties has been successfully used in the treatment of industrial wastewater (Ansari & Fahim, 2007; Donia et al., 2006). Synthetic ion exchange resins are generally composed of a polymeric moment body composition, typically based on polystyrene chains with divinylbenzene crosslinks and soluble ions based on the polymer chain. RLRC production methods and design specifications as follows.

- (1) RLRC filled with the substrate such as strong (weak) acid cation exchange resin, strong (weak) base anion exchange resin and chelating resin etc.. According to their pre-selected target species of heavy metal pollution sources, we further selected a suitable ion exchange resin as a filling base of RLRC.
- (2) Made into a category three-dimensional rectangular or triangular pyramid class monitoring package (Figure 2), the amount of ion exchange resin is placed within a well-permeable non-woven or mesh polyester fibers, and maintenance of water molecules out of the monitoring package freely without resistance.
- (3) RLRC divided into the frame base and no frame base. The monitoring bag with base frame is fixed in a plastic bag made of PE, PP and PVC etc. surrounding large pores in the middle of the hollow cylinder. In addition, front and rear sides of the monitoring bag with no base frame provided acrylic or other heavy cylindrical tube.
- (4) Using RLRCs were extensively spread in the monitoring areas to take down the evidence of the illegal pollution emissions after standing for some time duration. Monitoring time can be 1 hour, 6 hours, 1 day, 7 days ... 20 days, depending on site conditions need to be adjusted.
- (5) After recovering RLRCs within external cleaning and air-drying operations, resin was analyzed for elemental analysis via XRF. For the pollution emission behavior secretly at night, holidays or intermittent time, RLRC assorting with the spatial correlative analysis in GIS can grasp or lock the specific polluter that might help the victims achieve the compensation in law.

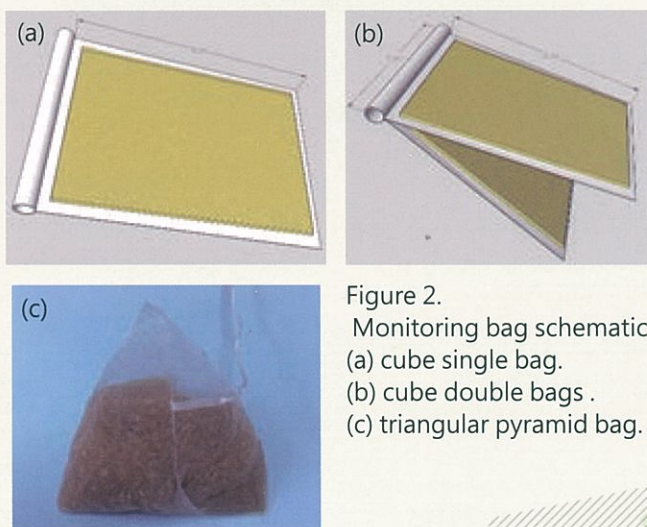


Figure 2.
Monitoring bag schematic
(a) cube single bag.
(b) cube double bags .
(c) triangular pyramid bag.

(四) Technological Competitiveness

Quantitative and qualitative analysis of test items in the material or contaminated natural water cycle of trace elements in the body is essential and chemical species produce changes in sampling and storage process so difficult to detect (Davison & Zhang, 1994). In 2009, Taiwan EPA began promoting passive sampling research work via its penetration of technology to capture heavy metals in water (凌永健, 2011).

Because of environmental factors on operating conditions difficult to control, there is no effective investigation sources used in ion exchange resin method. The present invention has been made in the field tests show that has reached the low cost, rapid analysis and tracking sources of effective monitoring methods.

(五)R&D Result

This study stressed that an effective monitor, low cost and rapidly analytic surveillance would be an urgent priority to trace the polluted cause under the limited resource examiner for polluted emissions in the government departments. Using the monitoring bags manufactured by ion exchange resin (called as RLRC) were extensively spread in the monitoring areas to take down the evidence of the illegal pollution emissions. The laboratory experiments to show that the cation exchanges a flux of resin and water body contact as a result more big, it adsorbs the efficiency of heavy metals more good. In accordance with the principle of conservation of mass, decreasing zinc concentration in water, which can be converted to the absorption rate of the cation exchange resin adsorption of heavy metals under the closed system. The test results showed that the adsorption rate of the resin increases with the accumulation time. The contact time with the heavy metal and cation exchange resin in solution for 30 minutes, cation exchange resin adsorption efficiency of heavy metals was up to 40%(Figure 3). This results also indicated that as long as an aqueous solution containing heavy metals and resins have a short contact, the phenomenon of ion exchange resin adsorption of heavy metals will occur in the open water environment.

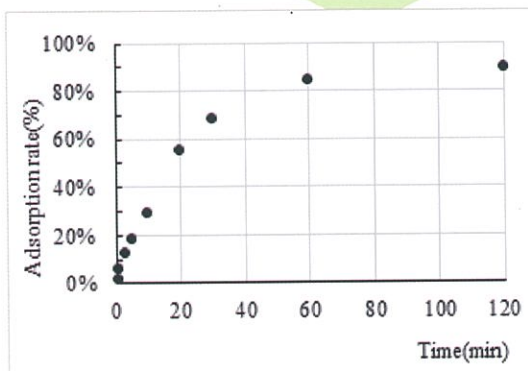


Figure 3.
Resin adsorption rate of heavy metals in water.

RLRC is a low cost, strong performance and easy implementation of the design concept as a tool for environmental monitoring. The present invention tends to exhibit simple, modern style, look forward to future commercial production, its product image by simple visual characteristics to mention a sense of the value of the product. Simultaneously, taking into account the complexity of modeling is not high can also be easily manufactured. The present invention has been patent substantive examination in 2015, named as "Measuring device with ion-exchange resin and measuring method thereof".

Acknowledges

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