Comparative study of heavy metals pollution in the Przemsza River bottom sediment: past and present

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Introduction:
Even small amounts of heavy metals present in river water are subject to very fast accumulation in bottom sediment. Assessment of bottom sediment thus allows early detection of environmental contamination and identification of point sources of pollution.
Przemsza river is one of the most polluted rivers in Poland. It flows through highly industrialized Upper Silesia region and it enters the Vistula river near Oswiecim (Auschwitz). The main sources of this river's pollution are the lead and zinc metal casting as well as hard coal processing industries.
This study involved the examination of the bottom sediment samples, collected in 2014, from the Przemsza river and its tributaries. The sampling points were the same as those taken in 1995 in prior research [1]. This allowed for the comparison of heavy metal accumulation in bottom sediment over a span of almost two decades.

Methods: Collected bottom sediment samples were homogenized, mixed and sieved through n <63 µm filter in the laboratory. Samples of the separated size fraction were then digested with conc. HNO_3 according to EPA 3051. The heavy metals concentration was determined by AAS method.

Results:
The maximum concentration of metals in the fraction <63 µm of the bottom sediment samples collected along the Przemsza River in the year 2014 and 1995 were as follows (mg/kg): Zn 28158 and 29580, Pb 9451 and 19510, Cd 154 and 269. The arithmetic mean concentration of all investigated metals in the size fraction <63 µm is comparable in both collection periods 2014 and 1995 and equals (mg/kg): Zn 16918 and 13505, Pb 4177 and 4758, Cd 92 and 134 respectively.
Very high metals' contamination is introduced to the Przemsza river by its tributaries [2]. In 2014 the concentrations of heavy metals in the bottom sediment of the most polluted rivers, Biala Przemsza and Sztola, were as follows [mg/kg]: 21822 and 26318 Zn, Pb 8872 and 7033, 167 and 137 Cd.

Discussion:
The concentrations of the analyzed metals were very high and exceeded several hundred times the background values established by Turekian & Wedepohl [3].
It was found that in 2014 the average Zn and Cd concentration in the Przemsza river bottom sediment was lower than in 1995, whereas Pb concentration increased. The 2014 study revealed that the Przemsza river is the cause of a significant increase of metal pollution in the bottom sediment of the Vistula river. Concentrations of Zn, Pb and Cd increase drastically after the outlet of the Przemsza into the Vistula river. Zn concentration increases from 507 to 3881 mg/kg, Pb from 311 to 1109 and Cd from 4 to 23 mg/kg.
Despite of decreasing activity from the mining and metal casting industries in the vicinity, extremely high concentrations of metals in the Przemsza river sediments have persisted indicating a low mobility of the analyzed metals.

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