



Determination of Heavy Metals in White Rice of Tarom Cultivar in First and Second Cultivation in Mazandaran Province, Iran

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Introduction

- Rice is one of the most important foods in the diet of people around the world. Statistics show that China, with the production of about 146 million tons of rice in the 2019-2020 crop year, has the highest production of this food in the world, and India and Indonesia with 118 and 34 million tons, respectively are located, in the second and third place in the world. In Iran, in 2020, 2.6 million tons of white rice were produced in the country at the area of about 800,000 hectares. Heavy metals are one of the most dangerous contaminants for health and enter the human body through food. Irrigation with sewage, pesticide and fertilizer application are the most important factors in increasing heavy metals in the soil and food.
- Mazandaran province, as the center of rice cultivation in Iran has the first rank in rice cultivation in. recent years, due to the economic attractiveness and the provision of the necessary infrastructure, the second cultivation of rice, in one year, has become common among farmers. Due to differences in climate and harvest time of the first and second types, there are differences in the quantity and quality of rice produced. In this study, the difference between the amount of heavy metals in these two types of cultivation has been investigated.

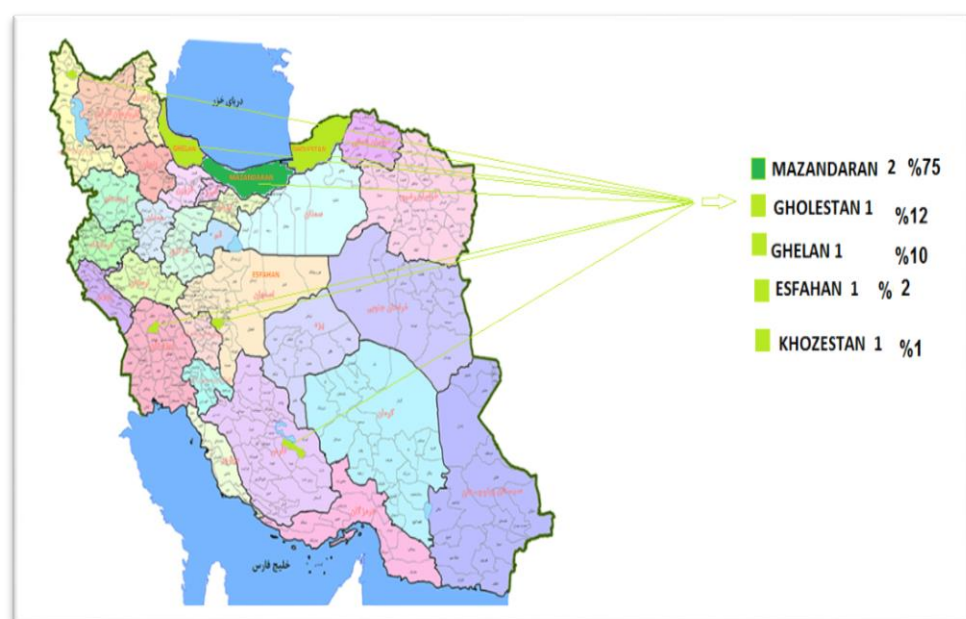


Fig 1: the rice producer provinces of Iran

Results:

Five heavy elements that have more effects on public health are Arsenic, Cadmium, Nickel, Mercury and Lead was studied in different treatments in Amol and Mahmoud Abad cities. Based on the selected design for this study, three treatments in each county and each in two crops were studied. The witness was also selected in Amol city in the southwest area in Suhra village.

Comparison of the amount of these five elements in different treatments in two cities shows that in order to match the results of data analysis, the total frequency of these 5 elements in the city of Amol is more than Mahmoud Abad. The results of the data in SAS program show that the highest amount of Arsenic belongs to the first culture of the second treatment of Amal city (Ab1) with 0.17 ppm. Also, the highest abundance of cadmium Cd belongs to the first culture of the third treatment of Amal city (Ac2) with 0.086 cultivar. In the case of Hg mercury, the highest cultivar is related to the first crop of the second treatment of Amol city (Ab1) with the cultivar 0.03 ppm. The figure is 0.53 ppm. Regarding the last element of lead pb, the highest cultivar is related to the second cultivation of the second treatment of Amol city (Ab2) with cultivar 25.66 ppm.

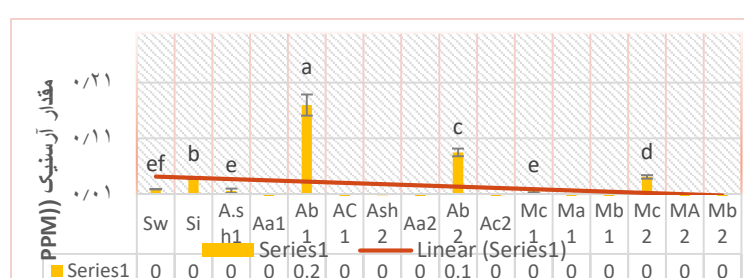


Fig 2: the amount of Arsenic in study area

Methods

- Samples were collected from local farms in Amol and Mahmoudabad during harvested period. All the heavy metals were determined by wet digestion method using a Flame Atomic Absorption Spectrophotometer based on international standard method of AOAC. The results show the increase of heavy metal in second cultivation. Therefore, food safety monitoring system for rice should be performed considerably.

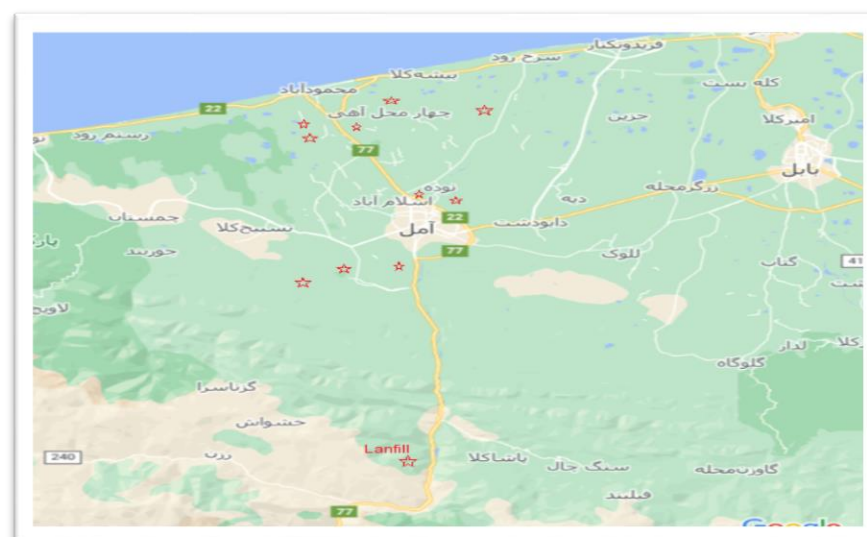


fig 3. The study area and samples selected sites

Conclusion:

Regarding the reason for the higher level of these elements and the significance of these figures in Amal city, two reasons can be imagined:

It can be related to the source of water being fed. Meanwhile, all the treatments studied in two crops in Amal city are fed from Haraz river, while the treatments of Mahmoud Abad city in the cultivation process are also fed from wells. So, Haraz River, in its course in Amol city, is faced with the entry of municipal, industrial and leachate sewage from landfills, as well as runoff through surface mines.

Also frequent use of chemical fertilizers containing elements p, k, N, and S in Mahmoud Abad and Amol regions could affect the results.

Another question that arises in this study is to find the reasons for the high levels of nickel and lead in the Amol region. This can be attributed to the higher rainfall in the second crop period. At this time, with the high traffic of cars on the Haraz-Tehran road and the retention of lead from fossil fuels, it can lead to an increase in the absorption of this element in the second crop. In the case of nickel, this can be attributed to the excessive use of chemical pesticides during the 65-day period of the second culture against pests, which leads to an increase in the rate of Nickel. Other question is why the amount of arsenic, cadmium and mercury in the first crop of most treatments is higher. This can be referred to the greater use of river water for irrigation of the first crop and the use of well water for irrigation of the second crop. Among these, the reason for this can be related to the high pollution of surface water to these three elements.

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