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Title

Comparison of sustainability of two wheat agroecoystems using emergy synthesis in Sistan, Iran

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Abstract

Today, water shortage and environmental degradation are considered as one of the biggest problems of human societies. In this situation, wastewater treatment and recycling, especially in dry and water-scarce areas like Sistan, is the most important solution in the development of water resources management, which can play an important role in water scarcity problems. This research was conducted at three villages of Se Qala, Deh Sadegh and Fethullah in Nimroz city of Sistan, in the north of Sistan and Baluchistan province. For this purpose, three wheat production fields were selected in each of the villages of Se Qala, Deh Sadegh, and Fethullah, which were irrigated with wastewater during the season, and three fields in the same villages that were irrigated with river water. The results of the experiment showed that the total emergy production in the fields irrigated with wastewater was 2.81E+9 and in the fields irrigated with wastewater was 3.34E+8 mjoules per hectare per year. In the fields irrigated with wastewater, the largest share total emergy is used for wastewater preparation (91.7%), nitrogen fertilizer (2.56%) and phosphorus fertilizer (2.46%), and in the fields irrigated with river water, nitrogen fertilizer (28.6%), soil organic loss (27.7%) and phosphorus fertilizer (20.5%) had the largest share of emergy. The comparison of emergy indices between the studied systems showed that wheat production using wastewater compared to river water has more 596% emergy for economic yield, 596% emergy for biological yied, 1112% emergy yield ratio, 797% standard environmental load ratio, 535.0% of the standard environmental sustainability index and 10,644% of the modified environmental sustainability index, while the renewable percentage was 88%, the standard energy investment ratio was 94.9%, the modified energy investment ratio was 10.5% and modified environment was 88.8% less in fields irrigated with wastewater than in fields irrigated with river water. In general, it can be said that although the use of wastewater caused more environmental pollution; But in terms of other indicators, it was superior compared to irrigation with river water.

Keywords: Emergy approach, Sustainability quantification, Environmental loading, wheat