

A Spatio-Temporal Assessment of the Water Quality in Tuul River, Mongolia

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Abstract

The study was carried out in the surrounding area of Ulaanbaatar, the capital city of Mongolia. The research indicates that the Tuul River is not polluted until the Ulaanbaatar city and the pollution starts when the river runs through the city. All high values of Water Quality Index are measured at a sampling point Tuul-lower Songino. The quality of the river strongly depends on how well water has been treated when discharged from Central Wastewater Treatment Plant. The distance between pollution point sources at downstream section of study area is not enough for the river self-purification process to take place. The water quality was decreased during the period of this study and the value of WQI increased. The WQI are calculated with greater values in cold period and with lower values in warm period of the year. The time series of water quality maps are produced.

Key words: water quality assessment, spatial and temporal changes, point source of pollution

Introduction

Over the last decade, rapid urbanization and increment of industries have been negatively influencing the water quality and chemical composition of rivers in surrounding areas of Ulaanbaatar city (Javzan *et al.*, 2004). Surface water quality in surrounding areas of Ulaanbaatar has been monitored at 14 points since 1980s. For this purpose, 10 sampling points along the Tuul River and 4 points at tributaries of the Tuul River (1 at Terelj river, 1 at Uliastai river, 2 at Selbe river), were chosen by the Central Laboratory of Environmental Monitoring (CLEM) (Ministry of Nature and Environment, 2006). Stationary hydro-biological monitoring of invertebrate species along the river has started since 1997.

In 1995, the self-purification coefficient of the river estimated by Mongolian scientists and concluded that the coefficient was 6.57 until it reaches first pollution point source, but it reduced to 0.98 after the Central Wastewater Treatment Plant (CWTP) discharge poured into the river. The treatment efficiency of the CWTP as well as other Wastewater Treatment Stations (WTSs) in the region is often inadequate due to technical and financial problems. Efficiency of the CWTP was 71% in 2002. This value dropped to 66% in 2003. Therefore, the plant was not operated in May 2003 and April 2004 (Orchlon, 1995).

Air, soil pollution and accumulated wastes in catchment area, which are transferred by surface runoff and flood channel, also have significant impact on the river water quality. Major causes of water pollutant are mining industries in lower basin of the Tuul River. Approximately, 179 licensed mining companies are operating in 145 km² areas of the basin (Ministry of Nature and Environment, 2006). Water demand of the city had increased by 20% from 1998 to 2005. Population growth, urbanization and intensity of industries have created water exploitation, deterioration of natural water regime and ecological degradation of the river basin (Roza-Butler, 2004).

The aim of this research is to assess spatio-temporal variability of Tuul River's water quality in surrounding area of Ulaanbaatar city using Surface Water Quality Index (SWQI) and to produce time series of the river water quality maps.

Materials and Methods

Study area. The study was carried out in surrounding area of Ulaanbaatar, the capital city of Mongolia. The Tuul River, flowing through the heart of the Ulaanbaatar city, is an environmentally, economically and socially significant natural resource. The study area covered Tuul River and its three tributaries, namely Terelj, Uliastai and