# 論文内容の要約 Summary of Thesis Contents

## 1．主論文要旨（論文提出時のもの） Abstract of Doctoral Thesis (summarized at the time of submission)

論文名 Title of Thesis

# Development and Applications of a Simple Ceramic Filter (SCF) for Water and Wastewater Treatment

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This thesis was designed to develop a low cost and simple ceramic filter (SCF) using cheap and locally available materials (Bangladesh local clay soil (80%) and rice bran (20%)) and to investigate its application in water and wastewater treatment processes. The cylindrical shaped SCF had an outer diameter of 10 cm with a thickness of 2 cm. The porosity and pore size was 60±1% and 1–5 µm, respectively. The manufacturing cost of a SCF was estimated to be US$ 0.2–0.3. The first application of the SCF was investigated to treat groundwater from arsenic (As). An As removal unit (ARU) was assembled using the SCF. The laboratory results showed that the ARU could successfully remove As(III) by adsorption and co-precipitation with the biological iron precipitate. It emphasized that the SCF could effectively separate the iron hydroxide floc. The practical field application in a rural area of Bangladesh over the course of 1 year also confirmed the high performance of ARU to remove As from actual contaminated groundwater. A developed model equation suggested that iron accelerated and phosphorus inhibited the As reduction. The ARU manufacturing cost (US$ 4–5) was significantly cheaper than other filters and affordable to the rural households. The second application of the SCF was investigated to treat domestic wastewater by using it in membrane bioreactor (MBR) process. The detail lab-scale experiments were carried out under gravitational filtration (three different mixed liquor (ML) heights and two BOD load conditions) and suction filtration (four different flux rates, same BOD load and same HRT conditions) modes. The SCF was submerged in the reactors. Synthetic wastewater containing carbon sources and synthetic greywater containing detergent surfactant were used. The SCF could efficiently separate the activated sludge floc. The flux performance was obtained 0.1–0.3 m/d for up to 1 year of operation without clogging the SCF under gravitational mode. A flux less than 0.2 m/d showed a lower risk of fouling in suction mode and simple physical cleaning was found suitable for SCF’s maintenance. High removal performance of organic and MBAS was obtained in intermittent aeration condition. This emphasized the necessity of aeration and produced effluents’ of a quality which could be reused for various non-potable purposes. The gravity filtration was found to be a more advantageous operation while using the SCF in MBR. The use of the SCF would reduce the cost of MBR for developing countries. Other possible applications of the SCF in water and wastewater sectors were also recommended.

## 2. 論文に関するリスト List on thesis

### (1) 学位論文の基礎となった学術論文【査読あり】

### The academic thesis that became a basis of your thesis【With review】

① Md. Mahmudul Hasan and Jun Nakajima, "Operational factors in membrane bioreactors using a simple ceramic filter", Journal of Water and Environment Technology (JWET), Japan Society on Water Environment, 12 (1), 65-75, 10th February 2014.

② Md. Mahmudul Hasan, Md. Shafiquzzaman, Jun Nakajima and Quazi Hamidul Bari, "Application of a simple arsenic removal filter in a rural area of Bangladesh", Water Science and Technology: Water Supply, IWA Publishing, 12.5, 658-665, April 2012.

③ Md. Mahmudul Hasan, Md. Shafiquzzaman, Md. Shafiul Azam and Jun Nakajima, "Application of a simple ceramic filter to membrane bioreactor", Desalination, Elsevier, 276 (1-3), 272-277, 2nd August 2011.

④ Md. Shafiquzzaman, Md. Mahmudul Hasan, Jun Nakajima and Iori Mishima, "Development of a simple, effective ceramic filter for arsenic removal" Journal of Water and Environment Technology (JWET), Japan Society on Water Environment, 9 (3), 333-347, 30th September 2011.

### (2) 国際会議発表【査読あり】

### Presentation in International Conference【With review】

【口頭】【Oral presentation】

① Md. Mahmudul Hasan, "Operational factors in membrane bioreactor using a simple ceramic filter", Water and Environment Technology Conference (WET-2013), Tokyo, Japan, 15~16 June 2013.

② Md. Mahmudul Hasan, "Membrane Bioreactor Process Using a Simple Ceramic Filter for Wastewater Reclamation and Reuse", 1st International Conference on Civil Engineering for Sustainable Development (ICCESD-2012), KUET, Khulna, Bangladesh, 23~24 March 2012.

③ Md. Mahmudul Hasan, "Application of a simple arsenic removal filter in rural area of Bangladesh", 4th IWA-ASPIRE conference and exhibition, Tokyo, Japan, 2~6 October 2011.

【ポスター】【Poster presentation】

① Md. Mahmudul Hasan, "Operational factors in membrane bioreactor using a

simple ceramic filter", Water and Environment Technology Conference (WET-2013), Tokyo, Japan, 15~16 June 2013.

② Md. Mahmudul Hasan "Development of iron mixed ceramic pellet for arsenic removal from groundwater", 4th IWA-ASPIRE conference and exhibition, Tokyo, Japan, 2~6 October 2011.

**(3) 学会誌に公刊された総説・解説**

**General remarks and Commentary published on Official journal of a Scientific society**

**(4) 国内学会発表 Presentation in Domestic Society**

**(5) 特許出願 Patent Application**