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From the Editor's desk

Greetings and a warm welcome to the first issue of ISAJ Newsletter for 2017!

Since this is the very first issue of the year, we take this opportunity to wish you all a happy and very productive 2017. May all your dreams come true during this year.

In this issue, we present four articles dealing with the diverse topics.

In the wake of two recent devastating earthquakes in the Asian region: the April 2015 Nepal earthquake (also known as the Gorkha earthquake) and the April 2016 Kumamoto earthquakes, in the article under Research Spotlight section, the author has shared his insightful thoughts about the lessons learned from these two catastrophic disasters. He has also focused on the importance of mainstreaming the disaster risk reduction, especially for India which has got densely populated urban sprawls in the seismically active regions.

Research Update section of this issue deals with how the mechanical properties of magnesium can be improved, by decreasing the grain size of the microstructure. The results have far-reaching effects in innovating the environment-friendly and energy efficient light material.

In this issue, we present articles by two young researchers under the section "From the Pen of Young Mind." Both the authors were the best poster awardees at the 6th annual ISAJ Symposium-2015. One deals with a detailed numerical simulation model developed for biological wastewater purification involving biochemical reactions by bacteria by using several substrates (or wastes), and another on the synergistic effects of two hormones, Motilin and Ghrelin on Gastrointestinal motility.

Finally, we present some pictures of the 7th annual ISAJ Symposium held on December 15th, 2016 at the Embassy of India Auditorium, Tokyo.

We hope you would find the present issue interesting and informative as well. We look forward to receiving your feedback on the current issue, and any suggestions/ ideas for improving the newsletter further.

In This Issue

ISAJ-2016 Attendees

Mainstreaming Disaster Risk Reduction

Nepal suffered heavy damage in 2015, due to the series of earthquakes that struck in and around the Katmandu Valley (The Gorkha Earthquake) in 2015. The events reminded the world about the devastating capabilities of a natural hazard. Due to the earthquake, many buildings had collapsed, while others were damaged severely. The earthquakes also exposed the vulnerability of certain kinds of buildings types, for example, the brick buildings with mud mortar. With the observations made during the Nepal earthquake, India, having regions with similar seismic characteristics and building types, has obtained a valuable opportunity to review its disaster mitigation strategies. The vast amount of data, obtained from the post-disaster survey of Nepal, enables the research community to hone its research prowess, in the field of disaster risk reduction/earthquake engineering.

Research in the field of earthquake engineering has many challenges. One challenge is bridging the gap between the academic research and the actual practices, in order to provide practical engineering solutions for disaster risk reduction.

Learning from past experiences is also an important aspect. Japan, a country well known for its disaster resiliency, has abundance of experience in tackling natural hazards. The challenge is to learn from the experiences of countries like Japan, and to create solutions depending on the environment where it has to be adopted.

Collapse of RC frame buildings in Kathmandu

One of the most important aspects of a disaster risk reduction strategy is the impact it has. The strategy should be effective on a large scale community level. This is where the major challenge arises; how to mainstream Disaster Risk Reduction. How to reach out to the masses and increase the awareness of the community against natural hazards and increase its disaster resiliency.

Many regions in India are in a precarious position. Many regions having densely populated urban sprawls, in seismically active regions, living in relatively weak buildings, which points towards an impending unavoidable large scale disaster. How to avoid this impending disaster is a challenge which involves not only the research community and the bureaucrats, but also every citizen of the country.

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Currently, Dr. Shanthanu is working as Engineering Consultant at Disaster Reduction and Environmental Engineering Dept. of Kozo Keikaku Inc. Tokyo, Japan. He is an alumnus of the University of Tokyo and received the doctorate degree from UoT. He completed his master degree from IIT Madras and the undergraduate degree from College of Engineering, Guindy affiliated to Anna University.

He has also worked as the post-doctoral researcher at the University of Tokyo. Major themes of his research are building (Masonry and RC) collapse simulation and dynamic soil-structure interaction modeling.

Grain-Size Effect on the Mechanical Behavior of Pure Magnesium

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Currently, Mohit Joshi is a doctoral student at the Kyoto University, Japan. He is all set to graduate on 23rd March 2017. The theme of his doctoral research is "Fabrication of fine-grained magnesium alloys and their mechanical properties."

He had obtained undergraduate and master degrees from Kumaun University and IIT Hyderabad, respectively. He had also worked at Birla Tyres for two years. He has been awarded JICA Friendship Scholarship to pursue his doctoral studies.

The global warming is an immediate concern of our society. One of the ways to combat this phenomenon is to reduce the carbon footprints by limiting the man-made CO_2. The environmental treaties like Kyoto protocol have recommended the use of light materials like Aluminum (Al), Magnesium (Mg) or polymeric composites for making the lightweight structure for energy efficient product designs. Magnesium-based alloys are the lightest among structural metallic materials having a high strength-to-weight ratio than aluminium and steels. They have better heat dissipation, electromagnetic shielding and recyclability then polymer composites. Therefore, they are used for constructing structures and frames across automotive, aerospace and electronics industries. But, the use of magnesium-based alloys is still somehow limited because of their inferior mechanical properties like low yield strength and poor ductility at room temperature. The improvement of their mechanical properties is one of the key strategies in the innovation of lightweight structures.

Magnesium is a polycrystalline metallic material composed of grains and grain boundaries. They have a hexagonal closed-pack (HCP) structure. The coarser grain size has an early activation of basal slips that reduces its yield strength and ductility during deformation. The reduction in the grain size can affect the activation of deformation modes and change the mechanical properties [1,2]. Therefore, to clarify the grain-size effect on the mechanical properties of pure magnesium, fine-grained and coarse-grained microstructures were fabricated and their mechanical properties were investigated. These different grain sized microstructures were fabricated by deforming magnesium through a severe plastic deformation (SPD) process known as high-pressure torsion (HPT) and subsequent annealing. The fine-grained and coarse-grained microstructure fabricated has an average grain size of 2.3 μm (Fig. 1(a)) and 7.8 μm (Fig. 1(b)) respectively [3]. The tensile test was done with a strain rate of 1 □ 10-3 s-1 at the room temperature (Fig. 1(c)). The fine-grained tensile specimen has a 50% improvement in the yield strength and ductility than the coarse-grained tensile specimen [3]. This result reveals that both the yield strength and ductility can be enhanced simultaneously in pure magnesium by decreasing the average grain size of the microstructure. Hence, the study suggests that the grain-refinement of the microstructure can be used to improve the mechanical properties of the other magnesium-based alloys by having similar effects on yield strength and ductility.

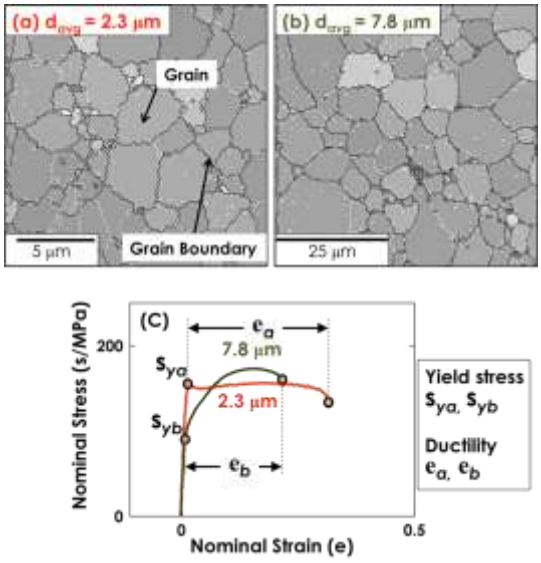

Figure.1: Nominal stress-strain curve of pure magnesium. (a) Grain boundary map of the fine-grained microstructure (2.3 μm) (b) Grain boundary map of the coarse-grained microstructure (7.8 μm) (c) Nominal stress -strain curves of the specimens tensile-tested at room temperature and a strain rate of 1 × 10-3 s^{-1} [3].

References:

1. Tsuji N., www.bnm.mtl.kyoto-u.ac.jp, 2010.
2. Tsuji N. *et. al*. Scripta Materialia, 47(12), 893-899, 2002.
3. Joshi M. *et. al.* , IOP Conference Series: Materials Science and Engineering,, 63, 012074, 2014.

Numerical Simulation of Bubbly Flows in an Aeration Tank with Biochemical Reactions

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Khateeb is pursuing his doctoral degree at the University of Tokyo. Prior to this, he has completed his master degree from the current lab itself. He obtained his bachelor degree from IIT Hyderabad.

Main topics of his research include Numerical Simulation of Biochemical Reactions in Wastewater, Numerical Simulation of Flotation, Multiphase Flows, MPI Parallelization, etc.

He is one of the best poster awardees at the 6th annual ISAJ Symposium-2015.

Purpose of research: The primary purpose is incorporation of all the biochemical reactions numerically in the aeration tank to create a model representing reactor of wastewater treatment using bubble plume system as the reaction tank. This study is an application of studies, Murai and Matsumoto [1]/Gong et al [2].

Biochemical Reactions: There are two main types of biological reactions, aerobic and Anaerobic/Anoxic reactions. Several substrates (or wastes) are used for consumption and simultaneous growth of bacteria. Overall, 14 different bacteria's and more than 50 substrates are computed in this system. Activated Sludge system is used for aerobic reactions (figure 1), Anaerobic Batch Digestion systems are used for

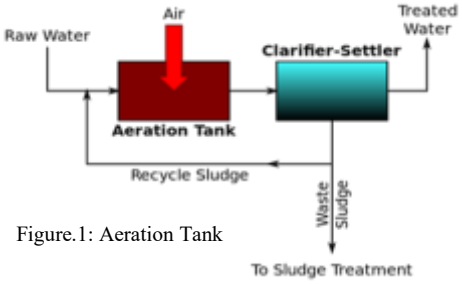

Figure.1: Aeration Tank

anaerobic/anoxic which is similar to aerobic system without aeration. Half reaction concept is used for resolving the reactions [3]. Reactions mainly follow Monod kinetics. Removal rate of substrate,

Simultaneously decay is occurring. Lysis and regrowth of bacteria is considered and is based on a model for regrowth by Dold et al. [4], where bacteria is continually undergoing death and lysis .

Governing equations: Combination of continuity equation and species conservation equation (Liquid phase) along with Navier-stokes equation for liquid phase and lagrangian model for air bubble tracking. Finite Volume Method is used for discretization and upwind scheme is used.

Validation is carried out using study, Mohan, S. Venkata, et al [5]. The results from study and model are compared (figure 2(a)). Error between slopes was about 3.5 %. Variation of waste consumption with bubble radius for central injection and with injection points (250 µm) are shown in figures 2(b) and 2(c) respectively.

Summary: A detailed model for biological wastewater purification involving reactions by bacteria's is developed. In study of variation of waste consumption with bubble radius, 100 µm gives best result (due to small size and high dissolution). But, 500 µm case gives better result than 250 µm (due to internal circulation). The results for study of variation of waste consumption with injection were as expected.

References:

1. Murai *et al*., ASME-Publications-FED, 236, 67-74, 1996.
2. Gong X. *et al*., Int J Multiphas Flow, 35, 155-162, 2009.
3. Grady C P L *et al*., Biological wastewater treatment. No. Ed. 3. IWA Publishing, 2011.
4. Dold P.L. *et al*., Prog Water Technol, 12, 47–77, 1980.
5. Venkata S. *et al*., Process Biochem, 40(5), 1501-1508, 2005.

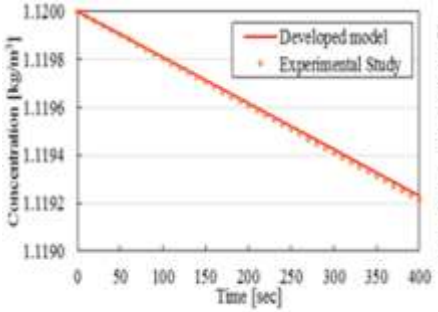

Figure 2(a): Validation

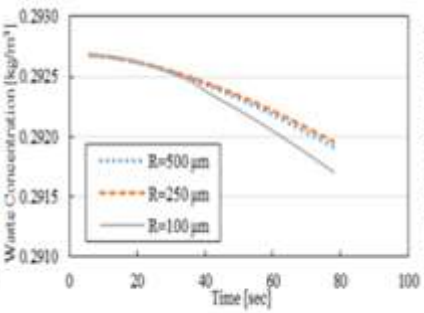

Figure 2(b): Variation with radius

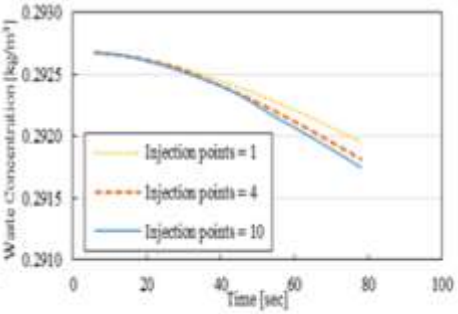

Figure 2(c): Variation with injection

Motilin and Ghrelin Affecting Gastrointestinal Motility

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Amrita is all set to receive her doctoral degree from Saitama University, Japan on March 2017. She has earned her master degree from Rajasthan University and her bachelor degree from Banasthali University, Rajasthan.

The theme of her doctoral thesis work was “Motilin- and ghrelin-induced gastric contractions in different parts of Suncus stomach in vitro."

She is one of the best poster awardees at the 6th annual ISAJ Symposium-2015.

Endocrine system is a system of glands that secrete hormones directly into the bloodstream to regulate multiple physiology of the body. Gastrointestinal tract is the largest endocrine organ of the body, and hormones produced in the gastrointestinal tract are physiologically important for their roles in development, growth, gastric motility, behavior and maintenance of energy homeostasis. Motilin and Ghrelin are considered to comprise a gut peptide hormone family; whose major physiological function is to regulate gastrointestinal (GI) motility. Gastrointestinal motility is the movement of the digestive system, and the transit of the contents within it. When nerves or muscle in any portion of the digestive tract do not function with their normal strength and coordination, a person develops symptoms related to motility problems.

During the interdigestive period, the migrating motor complex (MMC) is responsible for emptying the stomach. These rhythmic motor patterns originate from the foregut and propagate downward in the alimentary canal. Co-ordination of motilin and ghrelin is necessary for the initiation of phase III MMC contractions. My research aimed to find the synergistic effect of motilin- and ghrelin-induced gastric contractions in different parts stomach. I used Suncus murinus (Asian house shrew), a small mammal developed as a laboratory animal. Ghrelin, motilin, and their receptors in suncus have been previously cloned and identified in Suncus establishing it as a ghrelin- and motilin-producing animal model for the study of gastrointestinal motility.

Suncus stomachs were dissected and the fundus, upper corpus, lower corpus, and antrum were examined to study the effect of motilin and ghrelin using an in-vitro organ bath experiment. It was found that motilin and ghrelin-induced contractions differed in different parts of the stomach, and only the fundus and upper corpus induced gastric contractions with low dose motilin pretreatment while the other parts could not induce contraction. To confirm the functional results, mRNA expression of motilin receptor GPR38 and ghrelin receptor GHSR were measured in various parts of the stomach using quantitative and qualitative PCR analysis. GPR38 mRNA expression was higher in the upper corpus and GHSR mRNA expression was higher in the fundus and upper corpus than in other parts. Immunohistochemical analysis also showed the higher ghrelin cell density in fundus and upper corpus.

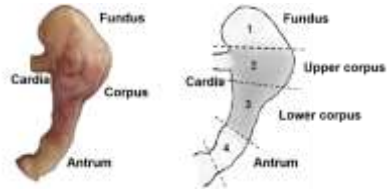

Figure 1. Stomach segments used in this study

This is the first report [1] suggesting that the proximal stomach may be the most sensitive and responsive to motilin- and ghrelin-induced synergistic gastric contractions. Moreover, the synergistic effects of motilin and ghrelin observed in the present study are probably species dependent, and clarifying the potential clinical application of these motilin/ghrelin-derived compounds would be interesting.

References:

1. Dudani A *et.al* , J Comp Physiol B 186(5) , 665–675, 2016.

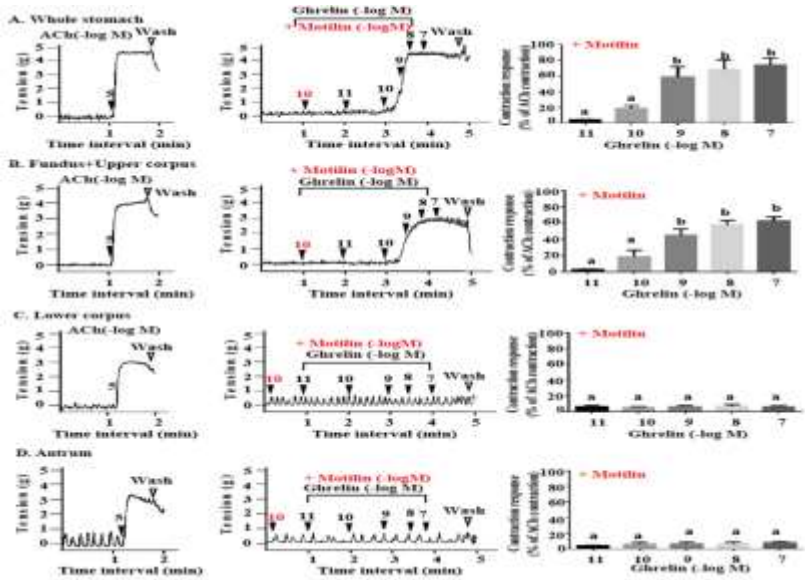

Figure 2. Motilin- and ghrelin-induced contractile activity in different parts of the isolated stomach

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