



# Laureates' Symposium





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**COUVE ROBERT BOSCH COLLEGE** 

#### 7<sup>TH</sup> INTERNATIONAL CONVENTION OF ENVIRONMENTAL LAUREATES FREIBURG, GERMANY - 15 - 18 MARCH 2018





Dipal Chandra Barua Bangladesh



United Kingdom

"Health risk of arsenic in food chain"



## Health risk of arsenic in food chain

Professor Bhaskar Sen Gupta OBE Heriot-Watt University, Edinburgh, UK Mr Dipal Barua, Chairman, BGEF, Bangladesh





## Arsenic – what is it?

Arsenic is a the 20<sup>th</sup> most common element on earth's crust; 14<sup>th</sup> in the sea and 12<sup>th</sup> in the human body.

It is a metalloid but readily forms compound with sulphur, iron and lead

Despite having various uses, arsenic compounds are highly toxic Arsenic trioxide,  $As_2O_3$  is most toxic and has no recognisable taste, colour or odour





Atomic no 33; grey (most common), yellow and black



 $As_2O_3$  white powder, water soluble ;  $LD_{50}$  15 mg/kg (rats,oral)

### Arsenic and Cancer Risk





The Denver Post

#### Arsenic's Effects on the Human Body

Nervoux System	Endocrine System
Impaired intellectual function	Diabetes Impaired glacose tolerance in pregnant women
	Respiratory System
Consumption System	Pelmonary tuberculouis Broachiectaalis Lung cancer
Renal System	Liver cancer
Kidney cancer Riadder cancer	
Shie	Developmental Process
Shin Lancer	Increased cancer that as adults Increased infant mortality Uncreased infant mortality Uncreased infant mortality Uncreased birth weight



Zhu, Y.-G., Williams, P. N., & Meharg, A. A. (2008). Exposure to inorganic arsenic from rice: A global health issue? 6 *Environmental Pollution, 154*(2), 169-171

## Arsenic in paddy – new disaster in Bengal Basin



Arsenic is sequestered in **iron plaque on root surfaces** in plants, regulated by phosphorus status.

Assuming an minimum daily rice consumption of 200 grams the researchers calculate that arsenic levels would have to be as low as 50 µg per kilogram of paddy to remain below the WHO limit for water.

However, arsenic levels in rice "commonly exceed" the 50-µg threshold and can reach **400 µg per kilogram** (Stone, 2008, Williams et al., 2007, Heikens, 2006)

Rice consumption in Asia can reach up to **900 gm/day** and bioavailability of As<sub>i</sub> in rice has been shown to be high (Juhasz et al., 2006)

#### Arsenic in Rice









## Arsenic in paddy – new disaster in Bengal Basin



http://www.speciation.net/News/Arsenic -species-in-rice-Origin-uptake-andgeographical-variation-;~/2013/05/15/6676.html

- Arsenic accumulation in rice straw at very high levels indicates that feeding cattle with such contaminated straw could be a threat to human health via contaminated bovine meat and milk (Abedin et al. 2002a).
- Arsenic speciation in the rice grain is dominated by inorganic arsenic (iAs) and dimethylarsinic acid (DMA).
- Monomethylarsonic acid (MMA) is occasionally detected as a minor component.
- Compared with iAs, methylated As species are taken up by rice roots less efficiently but are transported to the grain much more efficiently.
- Arsenite is taken up at high rates of influx, following Michaelis-Menten kinetics (Abedin et al. 2002b)

## As(III) & DMA Translocation in rice







Paddy rice needs >120 kg N, 60 kg P and 30 kg K per hectare + 25 kg urea

### As compounds are toxic- DMA is no exception

#### Limit your exposure

To reduce arsenic exposure, consider limiting rice in your family's diet to the quantities noted here. Our scientists based these recommendations on a person eating just one product per day or per week over a lifetime. If you eat more than one type, your risk would increase. Vary your diet to include non-rice products. If you exceed these limits one week, you can cut back the next.

Rice product	CO Infant cereal	Hot cereal	Ready- to-eat cereal	Rice drink	Rice	Rice pasta	Rice crackers	Rice cakes
Approximate serving size uncooked	34 cup	% cup	Tcup	1 cup	% cup	2 02.	16-18 crackers	1-3 cakes
Children	1 serving/day	1¼ servings/week	1½ servings/week	-	1¼ servings/week	1½ servings/week	1/2 serving/day	1 serving/week
Adult	NA	21/2 servings/week	3 servings/week	1/2 serving/day	2 servings/week	3 servings/week	1 serving/day	21/s servings/week





The Best Ways to Avoid ARSENIC IN FOOD



### Can we stop this mass poisoning ?

- Exposure from water –piped water supply is required. Small community plants are only suitable for remote areas.
- Exposure from food- selection of crops in arsenic affected areas. A simple practice like cooking rice in clean water and draining the starch helps.
- Dermal exposure could we avoid it ?





Traditional Rice Cooking



#### Rice Cooking in the Bengal delta

#### Rainwater harvesting and rice cooking in Cambodia

## Intervention- Washing with plant based bio degradable surfactants







## Working Mechanism of SAR



## Cambodian project in the lower Mekong delta





Figs (clockwise):

BGEF-Heriot Watt Arsenic Free Water Supply system in Bangladesh (Hosnabad PS, Comilla)











#### nproved Cooking Stove

Solar Irrigation Pump

**Bio Gas Plant** 



#### **Solar Irrigation Pump**

Q

The farmers of Bangladesh is facing many challenges from climate change. Imbalance and insufficient rainfall and heated weather causes less productivity. The farmers are assured of irrigation for their crops, even on the most overcast days. Especially The solar pumps enable an easy installation and transition from the traditional systems. This solar powered irrigation pump function without noise or pollution and require less maintenance. SIP can also contribute to the social income generation.

uring the dry season irrigation is very necessary for cultivation. Most of the power is limited to the rural areas of Bangladesh. Usually rural irrigation system relies on Low Lift Pump (LLP), Shallow Tube Well (STW) and Deep Tube Well (DTW). LLP and STW mostly use diesel and DTW is mainly operated by electricity. A solar powered irrigation pump is a best possible source to overcome this seasonal irrigation problem. The solar pumps reduces farmers' dependence on diesel supply, which is often costly particularly in remote rural areas.

BGEF has started installing Solar Irrigation pump in rural off grid areas to support the agricultural sector of the country. Already BGEF installed three (3) submersible pumps in the western part of Bangladesh (Kushtia) and replacing diesel run pumps. On an average these pumps are producing approximately 16 Lac liters of water from ground water source each day.

Negotiation is going on for providing consultancy and advice for scaling up renewable energy technologies, joint collaboration, replication in Asia, Africa and Europe. Set up very good linkages with top energy experts / businesses all the over the world

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# Thank You





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