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Climate Change Issue and Utilization of Nuclear Technology in Environmental Research: Bangladesh Perspective

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Climate Change Issues and Bangladesh

- **Bangladesh is one of the highly climate vulnerable countries with less than 1% of global Green House Gas (GHG) emissions.**
- **Threats due to climate change include here mainly sea level rise, droughts, floods, and cyclones.**
- **Bangladesh is nevertheless taking steps to reduce its future emissions through the development of renewable energy, the use of natural gas (relatively clean) and nuclear energy.**
- **Bangladesh committed to reduce GHG emissions in the power, industry and transport sectors by 5% unconditionally below BAU (business as usual) GHG emissions by 2030 or by a conditional 15% below BAU GHG emissions within 2030 if sufficient and appropriate support is received from developed countries.**

As a result, a target set in the power system master plan to deliver 5% of energy from renewable sources including nuclear power by 2015, and 10% by 2020 has been set by the Bangladesh government.

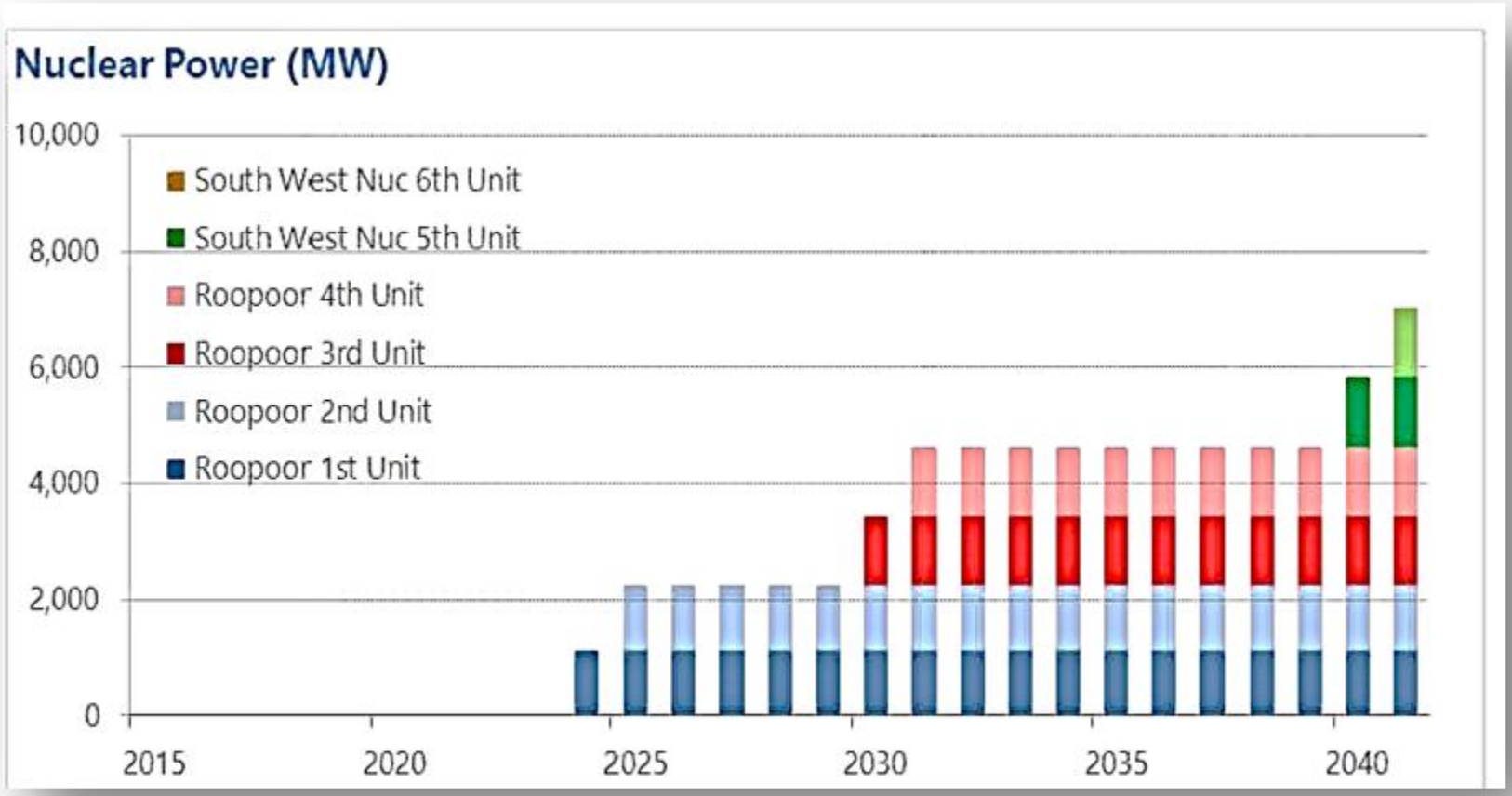


Fig. 1: Projected nuclear power development in PSMP-2016.

Nuclear Technology in Bangladesh for Adaptation with Climate Change

Bangladesh's priorities on climate change issues are mainly on adaptation.

- **The main research areas in Bangladesh for climate change adaptation are:**

  -Mutation breeding

  -Different dating methods (Pb-210 and C-14 etc.)

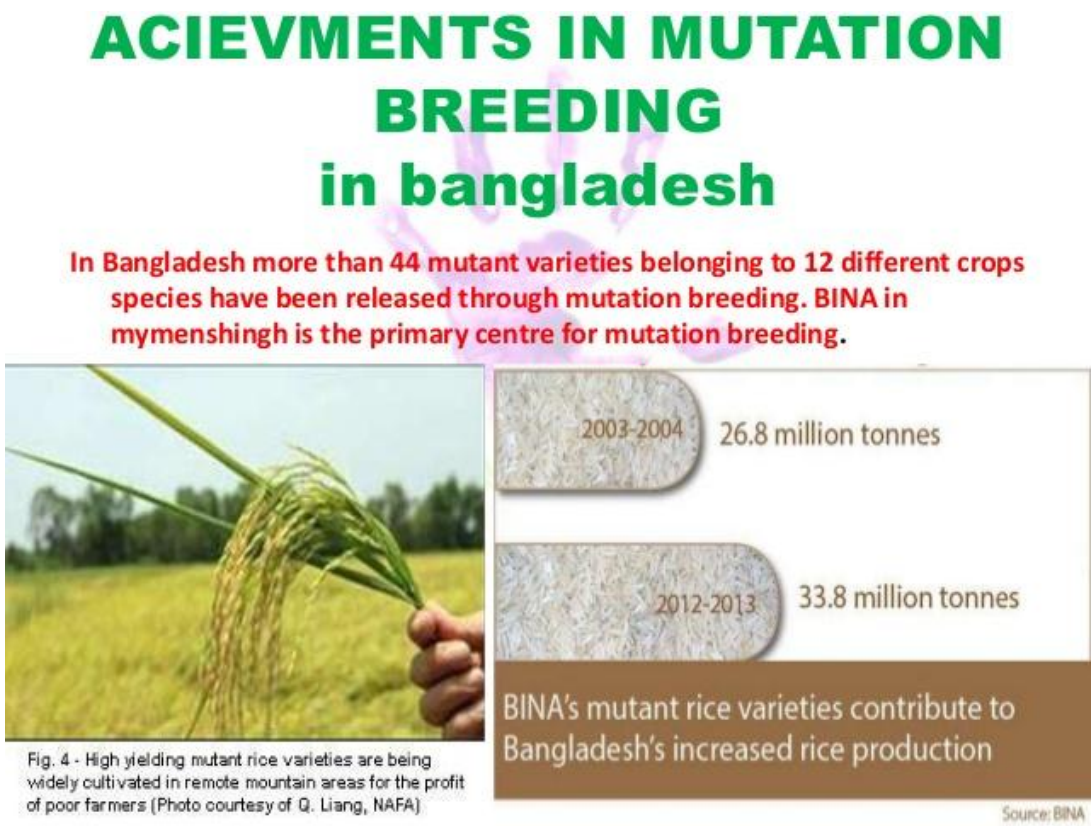


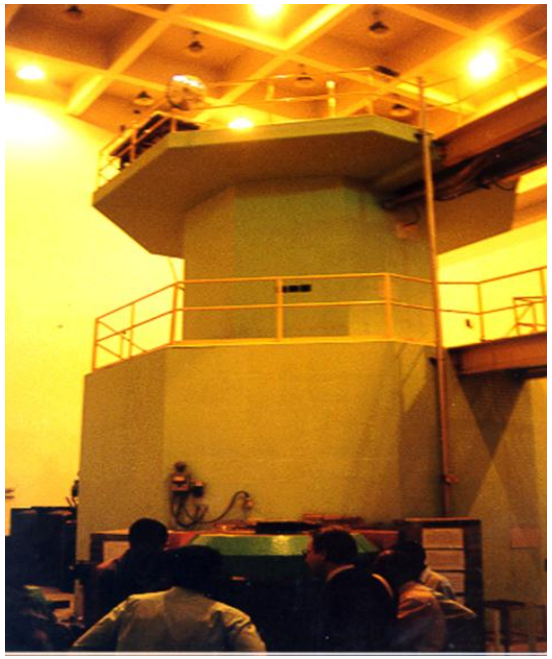
Fig. 4 - High yielding mutant rice varieties are being widely cultivated in remote mountain areas for the profit of poor farmers (Photo courtesy of Q. Liang, NAFA)

Nuclear Techniques for Environmental Contamination and Monitoring Study

- The following nuclear techniques are used for environmental study:
- TRIGA Reactor-based Neutron Activation analysis (NAA)
- ED-XRF technique
- Neutron Radiography
- Natural radioactivity monitoring using gamma-ray spectrometry system
- Others non-nuclear techniques used

  -ICP-MS

  -AAS



BAEC TRIGA Research Reactor

Gamma-ray spectrometry system

Subjects of Monitoring

The heavy metal contamination and natural radioactivity monitoring of the following subjects are performed-

-Soil and sediments (river and coastal)

- Water

-Food (Essential and toxic metal contents and health risk assessments)

-Air particulate

Challenges in Implementation

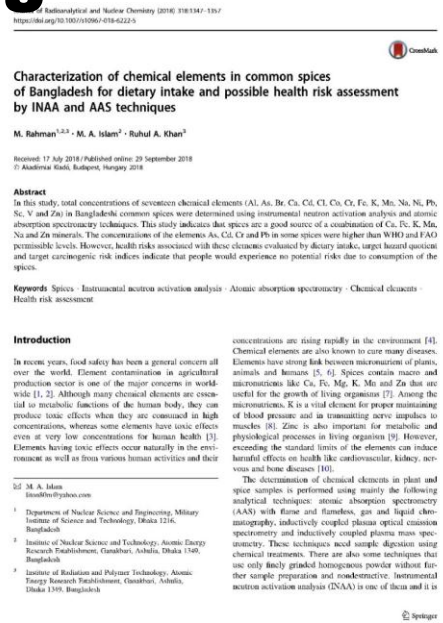
-Research reactor is old (35 years). So frequently in maintenance which hampered NAA.

- At this moment isotopic analysis technique with enough sensitivity is not available.

Food Safety and Health Risk Assessment

- Food safety has been a general concern all over the world.

- Health risks associated with toxic elements in food stuffs
- Evaluated by:
  - -Dietary intake
  - -Target hazard quotient
  - -Target carcinogenic risk indices
- These types of studies along with food provenance study will significantly contribute to the field of food safety and sustainable agriculture in Bangladesh.



Characterization of chemical elements in common spices of Bangladesh for dietary intake and possible health risk assessment by INAA and AAS techniques

M. Rahman · M. A. Islam · Ruhul A. Khan

Abstract

In this study, total concentrations of seventeen chemical elements (Al, As, Br, Ca, Cd, Cl, Co, Cr, Fe, K, Mn, Na, Ni, Pb, Sc, V and Zn) in Bangladeshi common spices were determined using instrumental neutron activation analysis and atomic absorption spectroscopy techniques. This study indicates that spices are a good source of a combination of Ca, Fe, K, Mn, Na and Zn minerals. The concentrations of the elements As, Cd, Cr and Pb in some spices were higher than WHO and FAO permissible levels. However, health risks associated with these elements evaluated by dietary intake, target hazard quotient and target carcinogenic risk indices indicate that people would experience no potential risks due to consumption of the spices.

Introduction

Assessment of Essential and Potentially Toxic Elements and Possible Health Risks in *Hylocereus undatus* and *Punica granatum*

M. Rahman · M. A. Islam · M. M. Zaved

Abstract

This study evaluates essential and toxic element contents in dragon (*Hylocereus undatus* (Haworth) Britton and Rose) and pomegranate (*Punica granatum* L.) and possible health risks through the consumption of these fruits. Total concentrations of 15 chemical elements (Al, Br, Ca, Cd, Cl, Cr, Cu, Fe, Hg, K, Mn, Na, Ni, Pb, and Zn) were determined by instrumental neutron activation analysis (INAA) and atomic absorption spectrometry (AAS) techniques. This study indicates that these fruits are a vital source of essential elements for human health. It is observed that Pb concentrations were higher in both fruits whereas Cd concentrations were slightly higher than WHO/FAO tolerable levels only in pomegranate. The estimated daily intake (EDI) of the chemical elements was within the maximum tolerable daily intake (MTDI) values. Furthermore, target hazard quotient (THQ) values were also within the safe level (THQ<1). However, the calculated target carcinogenic risk (TCR) values of Cd for pomegranate and Cr for dragon fruit were higher than the maximum limit (1.0×10^{-4}) for children. Finally, this study will create public awareness about micronutrient contents as well as metal contaminations of the studied fruits.

Introduction

Aquatic/Coastal Pollution

- **Anthropogenic pollutants in the environment-**
  - **-Heavy metals (HMs)**
  - **-Polycyclic aromatic hydrocarbons (PAHs)**
- **Monitoring and radiological hazard assessments of natural and anthropogenic radioactivity concentration.**

- **Mohammad Amirul Islam et al., 2020. Heavy metal contamination and ecological risk assessment in water and sediments of the Halda river, Bangladesh: a natural fish breeding ground. *Marine Pollution Bulletin (Elsevier), 160, 111649.***
- **R. Khan et al., 2020. Distribution, sources and ecological risk of trace elements and polycyclic aromatic hydrocarbons in sediments from a polluted urban river in central Bangladesh. *Environmental Nanotechnology, Monitoring & Management (Elsevier), 14,* p.100318.**
- **M. A. Islam, 2017. Contamination and ecological risk assessment of trace elements in sediments of the rivers of Sundarban mangrove forest, Bangladesh, *Marine Pollution Bulletin (Elsevier)*, 124, 356-366.**

Summary

- **Although Bangladesh is responsible for less than 1% of global GHG emissions, it is one of the highly climate vulnerable countries of the world. Bangladesh is nevertheless taking steps to reduce its future emissions through the development of different initiatives.**

- **Bangladesh is utilizing nuclear technology for environmental contamination monitoring, food safety and agricultural sustainability.**

- **Collaboration with international forum like IAEA, FNCA and other organizations will strengthen these activities in future.**

Thank you