Microbiological contamination of pond water and associated drinking water risk in rural coastal areas of Bangladesh

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Outline

- Study area
- Drinking water stress in normal situation and after cyclone
- Study design and data collection
- Results and discussion
- Research scope for further development
Drinking water problem aspects in normal situation

Spatially varied availability of sources and related seasonality aspects

Water fetching: Time consuming and Labor intensive
Drinking water problem aspects after cyclone

Damaged embankment, Contaminated sources and Refuge in cyclone shelters

Water relief, Embankment reconstruction, Restoration of contaminated sources
Study design and data collection

1. Previous scientific studies did consider four critical factors all together to get a comprehensive scenario of the problem:

   ➔ Contamination at source
   ➔ Contamination at the point of use
   ➔ Causes of contamination and remedial measures
   ➔ Significance of the contamination to affect the communities drinking water management

2. As study area, we have selected nine mauzas (revenue collection unit in Bangladesh) from the three coastal sub districts Sharankhola, Dacope and Shyamnagar.

3. We have collected **62 water samples**.
   ➔ 32 samples from ponds situated in 8 mauzas
   ➔ 30 samples directly from households pitchers

Source: Field Survey, 2012
4. We have tested the samples in the **four parameters**
   - Total coliform (TC)
   - Total bacterial count (TBC)
   - *Escherichia coli* (*E*.coli)
   - *Vibrio cholera*

5. For each of the 62 samples, additional information regarding the location, maintenance and relevant physical surroundings have been collected through GPS, and a quantitative questionnaire

6. A quantitative survey for 824 households have provided us information regarding the community’s drinking water management

Source: Field Survey, 2012
Results- Contamination scenario

1. The recorded maximum concentration of 

TC, HPC, and Ec in the source-samples is 8300 CFU/100ml, 45000 CFU/ml and 14000 CFU/100ml respectively.

The WHO standard for these three parameters is 0, less than 500 CFU/ml and 0 in that order.

2. The point of use (household samples) concentrations are comparatively lower in the cases of alum \([\text{KAl(SO}_4\text{)}_2\cdot12\text{H}_2\text{O}]\) use.

3. Presence of *Vibrio cholera* has been identified in about 42% samples.

Source: Field Survey, 2012
Results - Factors affecting the contamination rate

F1: Presence and functionality of a PSF installed beside the pond

F2: Presence of toilet within 10 m buffer

F3: Multipurpose use of the pond specially for bathing and cleaning

F4: The use of alum \([\text{KAl(SO}_4\text{)}_2 \cdot 12\text{H}_2\text{O}]\) for water purification at households

F5: Height of the pond bank from the adjacent land

F6: Contamination by previous cyclone surge

Source: Field Survey, 2012
Research scope - Rural water supply network

- Experimentally established by GIZ in SW-Coastal Bangladesh

- Water flow direction:
  Pond ► PSF ► Overhead Tank ► Supply Point

- 5 chambered PSF. 3 filled with sand, brick chips, alum and coal chips

- Solar energy runs the pump to let water in PSF and to pump the treated water in overhead tank
Thank you very much for your attention!

Acknowledgement:

Graduate School for Climate and Environment
Karlsruhe Institute of Technology

Karlsruhe House of Young Scientists
Karlsruhe Institute of Technology
Research approach - Data

Household Survey:
- Sample: 822
- 7% of total HH
- GPS coordinates of the surveyed HH

Qualitative Interviews:
- Semi structured: 51
- Expert interview: 10
- Group discussion: 3

Bacteriological test:
- Parameter: E. coli, Total coliform, Heterotrophic plate count, and V. cholerae
- Sample: 62 with GPS Coordinates

Necessary Data

Purchased Data:
- Water level and salinity data for selected river stations
- Temperature and precipitation data for 3 weather stations from 1971

Empirical Data

Secondary Data

Collected Data:
- Bore log aquifer data
- Hydro chemical data for 19 parameters including AS, Fe and Cl
- Digital Map of the study area

Necessary Data

Empirical Data

Secondary Data
Study Area at a glance

<table>
<thead>
<tr>
<th>District</th>
<th>Sub district</th>
<th>Mauza*</th>
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<tbody>
<tr>
<td>Satkhira</td>
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<td>Kupat</td>
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<td>Royenda</td>
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<td>Morellabad</td>
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</tbody>
</table>

*Mauza*: The smallest spatial unit for revenue collection; Have officially deliniated boundaries as well as official statistics (BBS, 2001)

**Parameter Information**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Information</th>
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<tbody>
<tr>
<td>Area (Km²)</td>
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<tr>
<td>Population</td>
<td>59946</td>
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<tr>
<td>Number of HH</td>
<td>12054</td>
</tr>
</tbody>
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Source: BBS, 2001