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# Technical Bulletin on Greywater Treatment and reuse in Mena

## Contents



## Introduction

Water Demand Management (WDM) is a management approach based on the premise that water is a scarce and finite resource. WDM aims to fulfil water needs by using governance tools and economic incentives to promote awareness for the efficient and equitable use of water.

More specifically, WDM measures include:

- Reducing resource wastage,
- Promoting water conservation and the use of non-conventional sources,
- Protecting water quality,
- Regulating access to the resource,
- Improving allocation among competing users, and
- Developing appropriate pricing mechanisms.

WDM implies that *wastewater be viewed as a resource*, and advocates its reuse following appropriate treatment for application in myriad activities such as crop production, irrigating green spaces and golf courses, groundwater recharge, influent for industrial cooling systems, domestic cleaning, as well as toilet flushing to name a few.

This bulletin aims to capture local knowledge on greywater treatment and reuse in the MENA region gained as a result of research projects funded and coordinated by IDRC. It is intended to highlight the future courses of action requisite to balance between the increasing challenges of water scarcity, food security and sustainable development.

In the Middle East and North Africa (MENA), the Urban Poverty and Environment Programme of the IDRC has worked with partners in the Palestinian Territories, Jordan and Lebanon to study and promote associated opportunities and challenges.

IDRC coordinates a regional Water Demand Initiative (WaDI*mena*), in partnership with the Canadian International Development Agency (CIDA) and the International Fund for Agricultural Development (IFAD). WaDI*mena* aims to facilitate intra-regional collaboration and ultimately promote effective water governance in MENA.

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It is estimated that greywater constitutes around 55 to 80% of domestic wastewater.

It is generally regarded that bathroom and laundry water pose minimal, if any, environmental or health hazard unless there are infants and babies in the household. As for water collected from the kitchen, its quality should be monitored due to the presence of organic matter from food remnants.

# UNDERSTANDING GREYWATER

## Definition

Greywater is non-industrial wastewater generated from domestic usages including showers, bathroom sinks, kitchen sinks, dishwashers and washing machines. It is distinguished from 'blackwater' (i.e. sewage), which is regarded as heavily polluted wastewater generated from the toilet and contains large concentrations of faecal matter and urine.

## Composition

The composition of greywater depends on each household's activities and varies according to socio-economic status, cultural practices, cooking habits, cleaning agents used, as well as demography. In general, greywater in low and middle-income countries may contain:

The main parameters usually assessed for greywater treatment purposes are identified in the Table below.

| | |
|---|---|
| • Soaps;<br>• Detergents;<br>• Fibres from clothes;<br>• Hair; | • Suspended solids;<br>• Dissolved solids<br>• Food particles;<br>• Grease;<br>• Oil. |

| Parameter | Definition | Greywater Use Implication |
|---|---|---|
| ph | An indicator used to identify whether a liquid is acidic or basic. | It is usually recommended that the pH of greywater is in the range of 6.5 to 8. |
| Salinity | Salinity is measured as the electrical conductivity of ions, both positive and negative, dissolved in greywater. High concentrations of total suspended solids (including chemicals such as potassium, calcium, sodium, phosphates, chlorides and nitrates) usually increase conductivity. | The salinity of greywater is of importance when it is used for irrigation, and usually determines whether there is a need to use salinity-tolerant crops. Also, there is a risk of increased salination of topsoil over the long term; however, this can be mitigated by assessing the characteristics of the soil and taking precautionary measures, such as applying humus to fixate the ions into the soil. |
| Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) | These indicators measure the concentration of biodegradable and non-biodegradable organic matter in greywater in order to determine its relative oxygen requirement i.e. how much oxygen must be consumed (oxidized) in order to breakdown the organic matter. More specifically, BOD measures the oxygen demand of the biodegradable matter while COD measures the oxygen demand of both biodegradable matter and non-biodegradable, oxidizable matter. | Greywater is generally regarded as easily biodegradable due to high BOD content. However, this will depend on the amount of:<br>• Water consumed in the household → low water consumption can lead to high concentrations of BOD and COD;<br>• Non-biodegradable detergents and surfactants → using these substances will increase the concentrations of BOD and COD. |
| Nutrient Content | Nutrients of concern are nitrogen and phosphorous and depend on the detergents and chemicals used. | High nitrogen content will inhibit the breakdown of organic matter allowing it to clog the soil, while high phosphorus may lead to algal growth. Both are fertilizers and can provide stimulation to plant growth. |

# Greywater Reuse

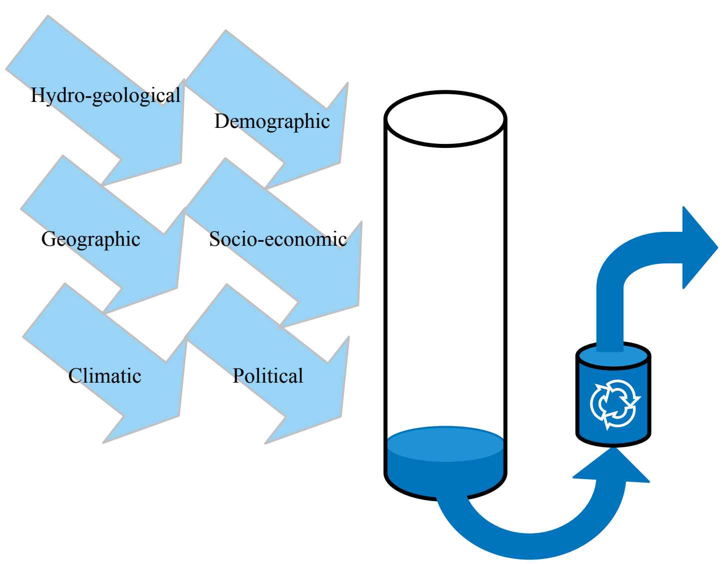
## Definition

Greywater reuse refers to the process of collecting domestic greywater and allowing it to pass through small-scale natural filters prior to being 'reused' for irrigation purposes.

## Rationale and Key Issues

IDRC has supported research into a simple, home-based WDM strategy that aims to make an efficient and productive use of a scarce resource. This greywater technology is only one of many options. Its prevalence has been gaining widespread momentum and support in the water-poor MENA region in light of its visible added value. Examples of benefits are illustrated below.

Relevant Inputs




**Socio-Economic Benefits**

- Mazimize use of existing potable water
- Generation of additional income through sale of crops and produce and through offsetting food purchases.
- Empowerment of women due to their leadership role in household water management.
- Creation of new job market for local plumbers and electricians where systems are being used.
- Reduction of water purchasing costs.
- Reduced septic emptying costs.

**Environmental Benefits**

- Decreased rate of groundwater and freshwater pollution from chemicals due to direct disposal of untreated water.
- Decreased rate of freshwater extraction.
- Reduced use of energy for wastewater treatment.
- Nutrification of topsoil as a result of reclaiming otherwise misdirected nutrients.
- Plant growth.
- Groundwater recharge.

It is evident that the most critical success factors ensuring a greywater project's sustainability are public acceptance and ownership. A lot of effort will need to go into gaining the trust of beneficiaries and local stakeholders as well as involving them in project planning and decision making; it is imperative that they understand and 'see' a number of tangible benefits that will be accrued from proper operation and maintenance of the treatment system

Although there is general regional support for greywater treatment and reuse, some work is still needed to ensure the technology's long-term viability. Specifically, three key issues still resonate:

- **Health concerns** related to locales where greywater is not properly handled or treated thereby posing a contamination risk to humans and the environment. Proponents of greywater reuse emphasise that community awareness and training sessions on operation, maintenance and monitoring directly reduce negative health impacts. Moreover, proper containment and treatment of the greywater safeguard the health of the surrounding environment; surface waters, groundwater, flora, fauna and soil.

- Insufficient data and studies assessing the **long-term environmental impacts** of greywater discharge on soil and crops. Despite the apparent room for research, there is widespread acknowledgement of the net benefits associated with reusing nutrient rich greywater in a controlled environment; i.e. where monitoring is in place.

- The need for more data on tangible **economic costs and benefits** in a wide variety of situations.

### Treatment

In general, treatment methods fall under three categories: biological, chemical and mechanical. The method adopted needs to be tailored according to local conditions as it depends on a number of factors including:

- Quantity and quality of the greywater;
- Treated effluent quality versus desired 'end use' of this reclaimed water;
- Affordability (installation, operation and maintenance costs);
- Necessary human resources;
- Aesthetic acceptability;
- Community requirements (if any); and
- Local regulations (where available).

**Tips for Reducing Treatment Requirements**

- Replace non-biodegradable cleaning products with natural, biodegradable ones
- Minimise the use of cleaning chemicals and detergents
- Minimise the disposal of chemicals into the sink
- Use a strainer in kitchen and bathroom sinks as well as shower drains to catch food particles, hair and other solids
- Place a filter on the washing machine's outlet to collect fibres – and clean, or replace, it regularly!

## MOVING FORWARD

In February 2007, experts, researchers and practitioners from eight different countries convened a four-day conference in Aqaba (Jordan) to assess the status of greywater research in the MENA and outline a road map for the way forward. The resultant was the "Aqaba Declaration on Greywater Use in the Middle-East North Africa Region" highlighted below.

**Aqaba Declaration on Greywater Use in the Middle-East North Africa Region**
February 15th, 2007

We 29 experts, researchers and practitioners from eight different countries and representing 17 institutions agree that greywater provides an important potential to alleviate water scarcity in dry countries and that it should be seen as a water source as opposed to a waste product. We also agree that reclaimed greywater use can be environmentally, socially and economically beneficial and culturally acceptable.

Greywater use must be promoted in a way that minimizes health and environmental risks while generating economic benefits.

Based on what is known to date, we also agree that:

- Greywater use is considered to have potential as a water demand management option for the MENA region and that we should respond to existing demand for non-conventional sources of water and promote the widespread adoption of greywater use.
- It is useful to see greywater both as a strategy to address water scarcity, as well as a poverty alleviation strategy.
- In order to raise the profile of greywater and promote its widespread use we need to work closely with all relevant stakeholders and should focus on clear and straightforward messages.
- We agree that more information is required, for example on:
  - Impacts of greywater use on health
  - Impacts of greywater use on soil and plants
  - Social and economic impacts
  - Greywater characterization
  - Appropriate technologies

We agree that any technological intervention be cost effective while meeting accepted standards.

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## ABBREVIATIONS

| | |
|---|---|
| BOD | Biological Oxygen Demand |
| CIDA | Canadian International Development Agency |
| COD | Chemical Oxygen Demand |
| IDRC | International Development Research Centre |
| IFAD | International Fund for Agricultural Development |
| L | Litres |
| $m^3$ | Cubic meter |
| MENA | Middle East and North Africa |
| WaDI*mena* | Water Demand Initiative for the Middle East and North Africa |
| WDM | Water Demand Management |

## RESOURCES

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