EUROPE-INBO 2016
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Treated wastewater reuse in Puglia region (Southern Italy): Experimental demo-scale activities

Alfieri POLLICE

alfieri.pollice@cnr.it
Puglia: 600-650 mm/year
136 m³/capita per year
absence of permanent rivers/natural lakes
Wastewater treatment and effluent reuse

Opportunities of reuse for irrigation in Puglia

Water demand in Puglia

Municipal wastewater potentially available for reuse in irrigation:
- Total estimate $\rightarrow 150 \text{ Mm}^3/\text{year}$
- Tertiary wastewater treatment plants currently available $\rightarrow 90 \text{ Mm}^3/\text{year}$
Treated wastewater reuse in irrigation
From treatment for effluent disposal
to water production for irrigation

Conventional wastewater treatment (activated sludge)

Raw waste → Pre-treatment → Primary settling → Activated sludge → Secondary settling → Tertiary treatments → Water body (river/lake/sea)

A) Upgrade or B) Polishing

IRSA demo-scale activities: Surface filtration combined to biological processes

A) Upgrade of activated sludge process (Membrane Bioreactors – MBR)

Raw wastewater → Pre-treatment → Primary settling → Activated sludge → ultra FILTR → DISINF → Effluent to irrigation

B) Polishing: Tertiary surface filtration processes

Secondary effluent → ultra FILTR → DISINF → Effluent to irrigation
IRSA activities on surface filtration for wastewater treatment and reuse

• Study of processes based on **low pressure surface filtration** for the production of water suitable for irrigation, study of microbiological quality and nutrient conservation.

• IRSA’s main research projects on treated effluent reuse:
  - 2000-2002: POM - national,
  - 2002-2006: PON – Aquatec - national,
  - 2005-2008: FP6 – Reclaim Water – EU,
  - 2006-2009: FP6 – Aquastress – EU,
  - 2010-2012: PRIN - national,
  - 2011-2015: PON – Interra (also agro-industrial ww) - national,
  - 2012-2016: FP7 KBBE – Water4Crops - EU-India,
  - 2013-2016: FP7 Inno-Demo – Demoware - EU,
Case study 1 (Aquatec 2000/2006): Tertiary membrane filtration

Cerignola WWTP 50,000 P.E.

Test field 2000 m²

Tertiary treatment (membrane) and storage tanks

Pilot plant of 700 L/h
Membrane flux: 30 L/m²/h
Membrane surface: 23.5 m²
Case study 1 (Aquatec 2000/2006): The pilot plant and the test field

2000 m² = 16 parcels 5x24 m
-drip irrigation (Soil Water Deficit 35%)
Case study 2 (PRIN 2010-2012): Fate of *E. Coli* in irrigation with treated wastewater

TEST FIELD irrigated with treated wastewater (MBR effluent) + *E. coli*

SOIL COLUMNS irrigated with partially treated real wastewater

Persistence of *E. coli* in surface soil and on grass?

*E. coli* (and NO$_3$) transfer through soil layers… possibly to groundwater?

Pilot scale MBR

Q=15 L/h
SRT=25 days; HRT=6 h
Prod./Relax=3h/6min

Case study 3 (Water4Crops 2011/2016): IFAS-MBR and GDF for direct irrigation

1) IFAS-MBR + UV
Pre-screened wastewater

2) GDF + UV
Secondary effluent

Test field (3000 m²)
Horticulture irrigated with treated effluents (including the WWTP outlet) and control (well water)
Case study 3 (Water4Crops 2011/2016): IFAS-MBR(*) with on-demand UV disinfection

Integrated Fixed film-Activated Sludge Membrane BioReactor

(*) Integrated Fixed film-Activated Sludge Membrane BioReactor
Case study 3 (Water4Crops 2011/2016): GDF(*) with on-demand UV disinfection

GDF – Cloth filtration (polyester), pores of 20µm

25m³/h

IN = secondary effluent

UV on demand

Test field

n. 6 lamps (Hg vapor)

Open channel UV-C disinfection

(*) Gravity Disk Filter
Case study 4 (Demoware 2011/2016):
Treated agro-industrial wastewater for irrigation

**Agro-ind. WW:**
- 12-15 mc/h
- Quality + flowrate fluctuations

**Tertiary treatment:**
- Sand filtration
- Membrane filtration
- UV on-demand
Case study 4 (Demoware 2011/2016): Treated agro-industrial wastewater for irrigation

Tomato (summer 2012, 2013 e 2014) and broccoli (winter 2012/13, 2013/14, 2014/15)
Case study 5 (Fasano full scale plant): Tertiary treatment for water distribution to farmers

Initial configuration
• Pre-chlorination (NaClO)
• Clariflocculation (AlCl₃)
• Post-disinfection (O₃/UV)

New configuration
1. Simultaneous dosage of:
   • AlCl₃ (clariflocculation)
   • NaClO or PAA (disinfection)
   • PAC (adsorption)
2. Lamellar packs settlers

Irrigation network:
• 1500 hectares
• 30 km piping
• 48 farms

Storage lake: 40,000 m³

Cost of tertiary treated water: 0,16-0,25 €/m³ (on the water bill)
Cost of distribution: depends on volume, distance, irrigation type (contracts with farmers)
THANKS FOR YOUR ATTENTION

alfieri.pollice@cnr.it