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Report
Description of Deliverable D.4 – WP1

Less-Water Bev.Tech
Contract ECO/13/630314

Reporting Date
22.07.2015

Project coordinator: **A DUE DI SQUERI DONATO & C. S.p.A.**

Project website: **lesswaterbevtech.com (online from March 31st, 2015)**

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Description of the Deliverable n. 4 of Work Package 1.

The Deliverable D.4 of Work Package 1 (WP1) included in the Annex I of the Grant Agreement for the Project Less-Water Bev. Tech (ECO/13/630314) regards the "Project coordination meeting #3".

Such meeting has taken place on July 22nd 2015, at A DUE S.p.A. premises in Riccò di Fornovo Taro (PR) – Italy, as scheduled during the previous meeting.

- **Meeting Participants:**

Participants:

- Ing. Simone Squeri, A DUE S.p.A., CEO;
- Dott. Federico Cappa, A DUE S.p.A., in-house consultant;
- Craig Clayton, CVAR Ltd, Owner, connected in teleconference;
- Ing. Marco Bortolini, Università di Bologna, senior researcher;
- Ing. Alberto Dilda, A DUE S.p.A., COO and R&D director;
- Ing. Micaela Guerzoni, A DUE S.p.A., subcontractor;
- Prof. Mauro Gamberi, Università di Bologna, associate professor;
- Ing. Alessandro Graziani, Università di Bologna, PhD researcher;
- Ing. Marco Iasoni, A DUE S.p.A., project engineer;
- Ing. Guido Marossa, A DUE S.p.A., project engineer;
- Ing. Maurizio Violi, subcontractor;
- Ing. Paolo Caselli, A DUE S.p.A., project designer automation;
- Ing. David Delmonte, A DUE S.p.A., Automation engineering Dept. Director;
- Ing. Gian Paolo Pescini, A DUE S.p.A., Mechanical engineering Dept. Director.

- **Meeting Agenda:**

The agenda for the meeting is the following:

- Presentation and discussion regarding the research on the regulation on the recycling of waste water in the food & beverage preparation (UNIBO+ADUE);
- Presentation and discussion regarding the research of technologies for the water sterilization alternatives to Ultra Filtration (UNIBO + ADUE);

- Discussion about the final technical specification of the pilot plant to be installed by the client premises, due the space available there (ADUE, UNIBO, Guerzoni Micaela and Ing. Violi Maurizio as subcontractors);
- Discussion regarding the definitive lay-out of the pilot plant and starting the engineering activities and executive design (ADUE, UNIBO, Guerzoni Micaela and Ing. Violi Maurizio as subcontractors);
- Schedule the next activities to be implemented;
- Schedule of the next Meeting.

- **Presentation and discussion regarding the research on the regulation on the recycling of waste water in the food & beverage preparation.**

During the meeting, UNIBO and ADUE presented the results on a research on the regulation for the recycling of waste water in the food & beverage preparation.

Giving the application of the pilot plant at the premises of an Italian beverage producer, the research has been focused on the regulation actually in force in Italy, with the related EU Directives, in the field of the fluids generated by the food & beverage industry and to be recycled in the same food & beverage industry.

The reference regulation appears very complex and with many overlapping layers, EU Commission & Parliament, National Government & Parliament, and Regional level, turning out in a very confused and contradictory law system.

The report concluded that the regulation does not regulate specifically the recycling of waste water, but regulate the minimum level of quantitative and qualitative standards that have to be respected in order to use a specific water into the production process.

- **Presentation and discussion regarding the research of technologies for the water sterilization alternatives to Ultra Filtration.**

During the meeting, UNIBO and ADUE presented the results of the activity of research on the technologies for the waste water treatment and sterilization, focused in particular on the technologies alternatives to the Ultra Filtration.

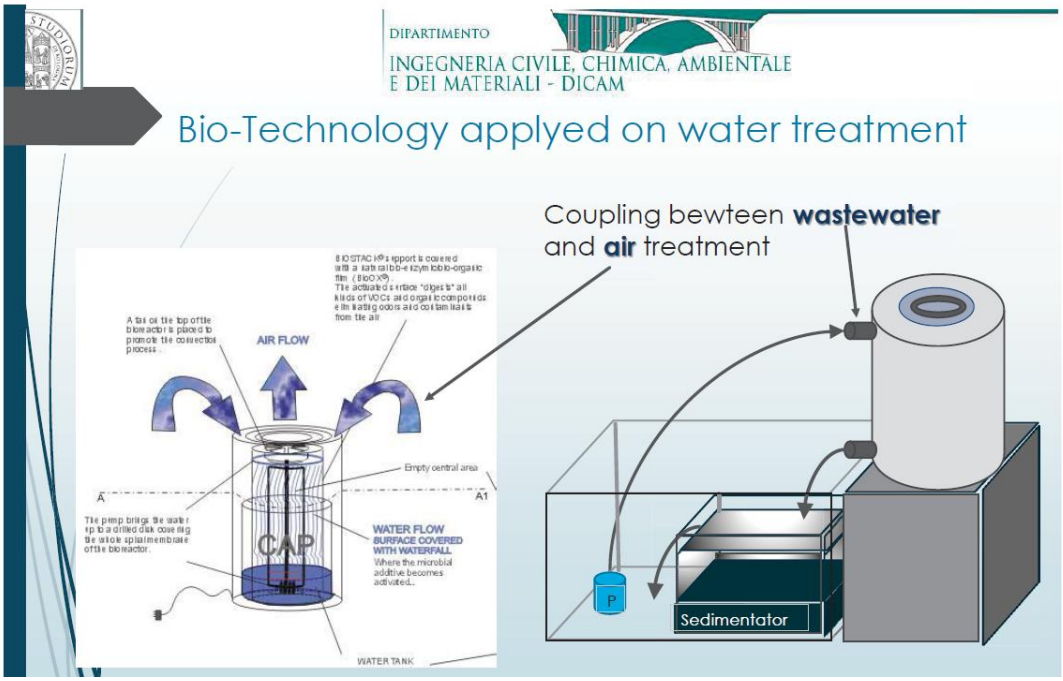
In particular, the activities of research focused on new biotechnological solutions and bioreactors.

The following figure reports the reference schemes of this solution applied to waste water of industrial origin.

The conclusions of the study were:

- The ability of the new technology to degrade contamination into wastewater from industrial production has been demonstrated;

- More test applications are required in order to assess the robustness of the solution proposed, so the technology needs more research and testing before considering the application to an industrial plant;
- In a cost-effective perspective, the implementation of this system appears to be suitable within a multi-stage treatment process, like the one proposed by the Less-Water Bev.Tech. project.



- **<u>Discussion about the final technical specification of the pilot plant to be installed by the client premises, due the space available there, and…</u>**
- **<u>Discussion regarding the definitive lay-out of the pilot plant and starting the engineering activities and executive design</u>**

During the previous months, "Consorzio Casalasco del Pomodoro" (Casalasco Tomato Consortium) confirmed the intention to install the pilot plant at its production premises located in Fontanellato (PR), Italy.

The total amount of space dedicated is of about an area of 20x5 meter.

Thus, the engineering of the pilot plant has been developed to be integrated in the Consorzio Casalasco del Pomodoro plant.

The Consorzio Casalasco del Pomodoro in Fontanellato is a complex plant that manufactures products derived from tomatoes, starting from the raw material (purées, concentrates,..), but also vegetable pottages and soups, almond milk, in addition to fruit juices and tea, it was therefore necessary to choose a part of the wastewater resulting from such different types of production.

Taking into account that the process ADUE wanted to develop for water recovery is a continuous process, the choice of wastewater fell on those sources that could guarantee (added) a near-continuous flow rate of 45000 l/h.

In this case for the above mentioned reasons and for specific reason ADUE can't collect the waste from sugar syrup preparation, syrup blending unit, carbonation unit, pasteurization unit and CIP unit.

However, ADUE considered these discharges. These discharges of discontinuous nature are stored separately before being dosed in the main flow continuously, as will be described later (Sugar syrup preparation, syrup blending unit, Carbonation unit, Pasteurization unit, CIP unit).

Therefore, it was decided to recover two types of waste water from the plants, the waste water of osmosis 15000 l/h which has the following chemical analysis:

Parametri / Prove	Unità di misura	VALORE Inc. Estesa	Data analisi inizio - fine	Metodo di prova
Ammoniaca (come NH4)	mg/l	< 0.050	01/06 01/06	APAT CNR IRSA 4030 A2 Man 29 2003
Bario (Ba)	µg/l	558 ± 17	04/06 08/06	EPA 6020A 2007
Cloruri (Cl)	mg/l	397 ± 48	01/06 01/06	APHA Standard Methods for the Examination of Water and Wastewater ed 22nd 2012 4110B
Conducibilità (a 25°C)	µS/cm	3110	01/06 01/06	APAT CNR IRSA 2030 Man 29 2003
Ferro (Fe)	µg/l	< 20.0	04/06 04/06	EPA 6020A 2007
Fluoruri (F)	mg/l	0.62 ± 0.18	01/06 01/06	APHA Standard Methods for the Examination of Water and Wastewater ed 22nd 2012 4110B
Magnesio (Mg)	mg/l	117.9 ± 3.9	04/06 08/06	EPA 6020A 2007
Manganese (Mn)	µg/l	< 5.00	04/06 04/06	EPA 6020A 2007
Nitrati (NO3)	mg/l	21.3 ± 3.7	01/06 01/06	APHA Standard Methods for the Examination of Water and Wastewater ed 22nd 2012 4110B
Indice di permanganato (Ossidabilità Kubel)	mg/l O2	< 0.50	01/06 01/06	UNI EN ISO 8467:1997
pH	unità di pH	7.3 ± 0.1	01/06 01/06	APAT CNR IRSA 2060 Man 29 2003
Potassio (K)	mg/l	7.97 ± 0.29	04/06 04/06	EPA 6020A 2007
Silice (SiO2)	mg/l	38.62	05/06 05/06	APAT CNR IRSA 4130 Man 29 2003
Sodio (Na)	mg/l	185.6 ± 7.9	04/06 08/06	EPA 6020A 2007
Solfati (SO4)	mg/l	258 ± 33	01/06 01/06	APHA Standard Methods for the Examination of Water and Wastewater ed 22nd 2012 4110B
Solidi sedimentabili (2 ore)	ml/l	< 0.10	01/06 01/06	APAT CNR IRSA 2090 C Man 29 2003
Solidi sospesi totali	mg/l	< 1.0	05/06 05/06	APAT CNR IRSA 2090 B Man 29 2003
Torbidità	NTU	< 0.40	01/06 01/06	APAT CNR IRSA 2110 Man 29 2003
Calcio (Ca)	mg/l	392 ± 14	04/06 08/06	EPA 6020A 2007
Alcalinità P (come CaCO3)	mg/l	< 5.0	01/06 01/06	APAT CNR IRSA 2010 B Man 29 2003
Alcalinità T (come CaCO3)	mg/l	996	01/06 01/06	APAT CNR IRSA 2010 B Man 29 2003
Alcalinità equivalente a bicarbonati (HCO3)	mg/l	1220	01/06 01/06	APAT CNR IRSA 2010 B Man 29 2003
Alcalinità equivalente a carbonati (CO3)	mg/l	< 2.0	01/06 01/06	APAT CNR IRSA 2010 B Man 29 2003
Alcalinità equivalente a idrossidi (OH)	mg/l	< 2.0	01/06 01/06	APAT CNR IRSA 2010 B Man 29 2003

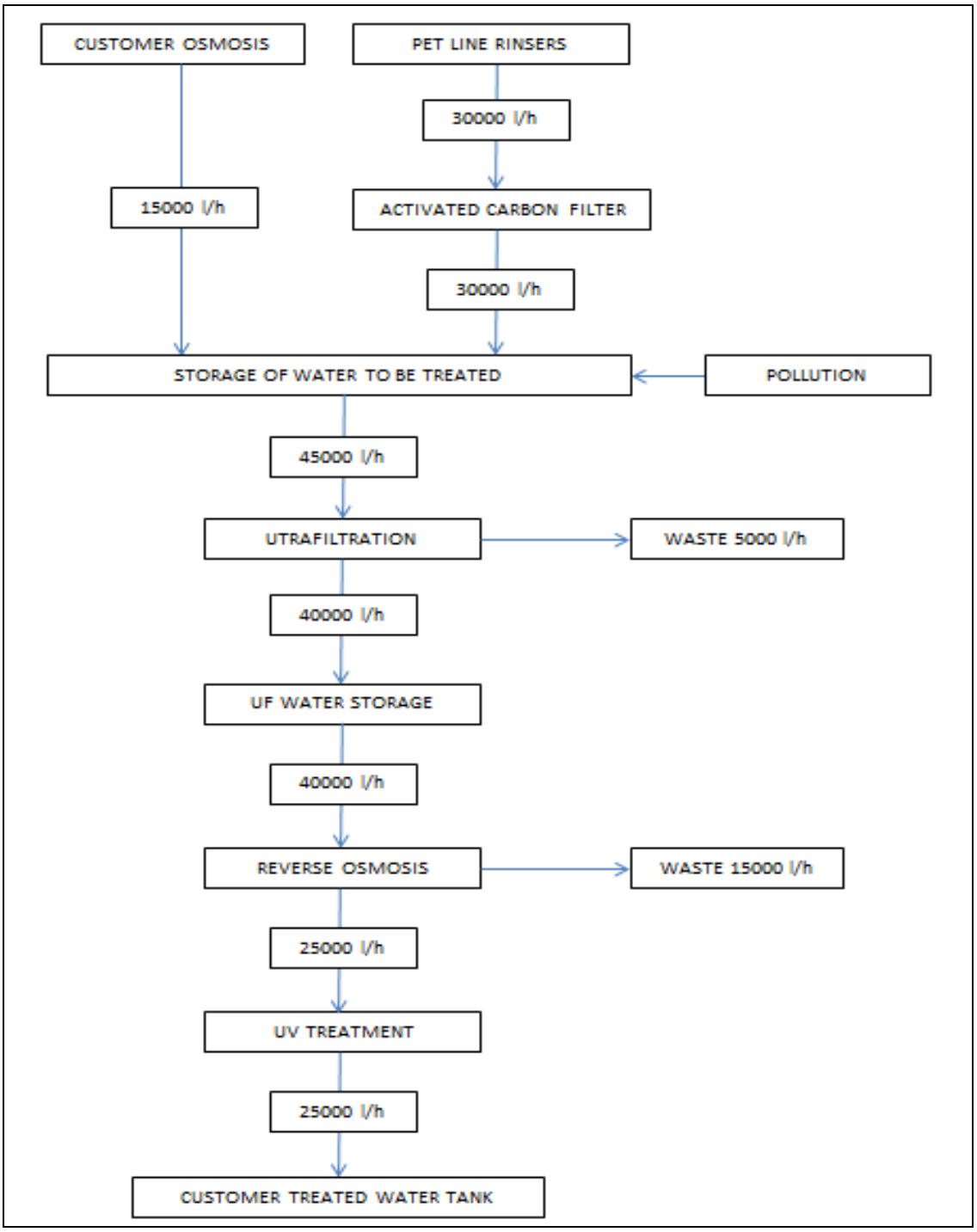
Chemical analysis of waste water of osmosis 15000 l/h

Water coming from the bottle rinsers of three PET aseptic bottling lines in the factory for a total of about 30000 l/h and which have the following chemical characteristics:

Parametri / Prove	Unità di misura	VALORE Inc. Estesa	Data analisi inizio - fine	Rec. %	Metodo di prova
Ammoniaca (come NH4)	mg/l	< 0.050 ± 0.042	07/11 07/11		APAT CNR IRSA 4030 A2 Man 29 2003
Bario (Ba)	µg/l	< 50.0 ± 3.2	07/11 07/11		EPA 6020A 2007
Cloruri (Cl)	mg/l	4.4 ± 1.7	07/11 07/11		APHA Standard Methods for the Examination of Water and Wastewater ed 22nd 2012 4110B
Conducibilità (a 25°C)	µS/cm	53.6 ± 3.6	07/11 07/11		APAT CNR IRSA 2030 Man 29 2003
Ferro (Fe)	µg/l	< 20.0 ± 3.4	07/11 07/11		EPA 6020A 2007
Fluoruri (F)	mg/l	< 0.15 ± 0.14	07/11 07/11		APHA Standard Methods for the Examination of Water and Wastewater ed 22nd 2012 4110B
Magnesio (Mg)	mg/l	< 0.200 ± 0.024	07/11 07/11		EPA 6020A 2007
Manganese (Mn)	µg/l	< 5.00 ± 0.46	07/11 07/11		EPA 6020A 2007
Nitrati (NO3)	mg/l	< 3.0 ± 2.7	07/11 07/11		APHA Standard Methods for the Examination of Water and Wastewater ed 22nd 2012 4110B
Indice di permanganato (Ossidabilità Kubel)	mg/l O2	48.6 ± 3.1	07/11 07/11		UNI EN ISO 8467:1997
pH	unità di pH	3.9 ± 0.1	07/11 07/11		APAT CNR IRSA 2060 Man 29 2003
Potassio (K)	mg/l	< 0.200 ± 0.015	07/11 07/11		EPA 6020A 2007
Potenziale redox	mV	298	07/11 07/11		MP 436 rev 0 2008
Silice (SiO2)	mg/l	0.60	12/11 12/11		APAT CNR IRSA 4130 Man 29 2003
Sodio (Na)	mg/l	4.37 ± 0.24	07/11 07/11		EPA 6020A 2007
Solfati (SO4)	mg/l	< 4.0 ± 3.4	07/11 07/11		APHA Standard Methods for the Examination of Water and Wastewater ed 22nd 2012 4110B
Solidi sedimentabili (2 ore)	ml/l	< 0.10	07/11 07/11		APAT CNR IRSA 2090 C Man 29 2003
Solidi sospesi totali	mg/l	< 1.0	10/11 10/11		APAT CNR IRSA 2090 B Man 29 2003
Torbidità	NTU	< 0.40	07/11 07/11		APAT CNR IRSA 2110 Man 29 2003
Calcio (Ca)	mg/l	0.478 ± 0.080	07/11 07/11		EPA 6020A 2007
Alcalinità P (come CaCO3)	mg/l	15.8	10/11 10/11		APAT CNR IRSA 2010 B Man 29 2003
Alcalinità T (come CaCO3)	mg/l	63.4	10/11 10/11		APAT CNR IRSA 2010 B Man 29 2003
Alcalinità equivalente a bicarbonati (HCO3)	mg/l	38.6	10/11 10/11		APAT CNR IRSA 2010 B Man 29 2003
Alcalinità equivalente a carbonati (CO3)	mg/l	19.0	10/11 10/11		APAT CNR IRSA 2010 B Man 29 2003
Alcalinità equivalente a idrossidi (OH)	mg/l	< 2.0	10/11 10/11		APAT CNR IRSA 2010 B Man 29 2003

Chemical characteristics of water coming from the bottle rinsers

The process plant will therefore have the following block diagram:



Process plant

The interface with existing plants is fairly simple and involves the positioning of collection tanks below the four discharges that we want to recover. Each tank is equipped with a water booster pump with an automatic on-off valve and an automatic drain valve. In this way you can decide at any time to retrieve the water or to dispose of it without having to intervene on the machines that produce the waste.

Anyway, several options have been evaluated, but then the current option was chosen because it is not easy (in terms of costs, stop time, warranty) to do modification in the existing plant.

Moreover, the Ultra Filtration system was developed in a lay-out than to be used for executive engineering and design.

Finally, the integration of existing beverage preparation units with the new waste water system were investigated and engineered, in order to collect water from existing production units and its delivery to the waste water system.

- **Next steps.**

  - Next meeting will be on **10th December 2015**.
    - Check on executive engineering activities of the pilot plant.

  - The activities to be implemented in the meantime are:
    - Engineering and realization of the new double reverse osmosis water treatment plant for the pilot plant;
    - Engineering of the integration of the existing syrup preparation plant with the new units;
    - Engineering and realization of water recovery system;
    - Engineering and realization of control and supervising system;
    - Start of the exploitation activities.

1.1 Results achieved as compared to what was planned in the project proposal

Results in line with the plan in the project proposal, with improvement decided on the prototypal water treatment system to be realized.

1.2 Deviations, problems and corrective actions taken in the whole project period

No deviations, problems or corrective actions have emerged so far.

2 Other issues (max 1 page)

No other issues have emerged so far.

3 Overview on hours spent

Will be regularly submitted with the Progress Report #1 on month 12 (September 2015).

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