



## By-product reuse in drinking water softening: influence of operating conditions on calcium carbonate pellet characteristics

Tang, Camilla; Rosshaug, P. S.; Kristensen, J. B.; Rygaard, Martin; Albrechtsen, Hans-Jørgen

*Publication date:*  
2017

*Document Version*  
Peer reviewed version

[Link back to DTU Orbit](#)

### *Citation (APA):*

Tang, C., Rosshaug, P. S., Kristensen, J. B., Rygaard, M., & Albrechtsen, H-J. (2017). *By-product reuse in drinking water softening: influence of operating conditions on calcium carbonate pellet characteristics*. Abstract from 4th Water Research Conference: The Role of Water Technology Innovation in the Blue Economy, Waterloo, Ontario, Canada.

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

**Important notes:**

Do **NOT** write outside the grey boxes. Any text or images outside the boxes **will** be deleted.

Do **NOT** alter the structure of this form. Simply enter your information into the boxes. The form will be automatically processed – if you alter its structure your submission will not be processed correctly.

Do not include keywords – you can add them when you submit the abstract online.

**Title:**

**By-product reuse in drinking water softening: influence of operating conditions on calcium carbonate pellet characteristics**

**Authors & affiliations:**

C. Tang<sup>\*1,3</sup>, P. S. Rosshaug<sup>2</sup>, J. B. Kristensen<sup>3</sup>, M. Rygaard<sup>1</sup> & H.-J. Albrechtsen<sup>1</sup>  
<sup>1</sup>Technical University of Denmark, Denmark; <sup>2</sup>HOFOR, Greater Copenhagen Utility, Denmark;  
<sup>3</sup>NIRAS A/S, Denmark  
[catang@env.dtu.dk](mailto:catang@env.dtu.dk)

**Abstract:** (Your abstract must use **Normal style** and must fit in this box. Your abstract should be no longer than 300 words. The box will 'expand' over 2 pages as you add text/diagrams into it.)

**Preparation of Your Abstract**

1. The title should be as brief as possible but long enough to indicate clearly the nature of the study. Capitalise the first letter of the first word **ONLY** (place names excluded). No full stop at the end.

2. Abstracts should state briefly and clearly the purpose, methods, results and conclusions of the work.

Introduction: Clearly state the purpose of the abstract

Methods: Describe your selection of observations or experimental subjects clearly

Results: Present your results in a logical sequence in text, tables and illustrations

Discussion: Emphasize new and important aspects of the study and conclusions that are drawn from them

Water utilities are becoming increasingly aware of the environmental sustainability of drinking water production and distribution, while still producing water meeting regulatory guidelines in a cost-effective manner. In areas with high water hardness, central drinking water softening can provide both socio-economic and environmental benefits. However, optimal implementation of softening requires a holistic approach including e.g. possibilities for by-product reuse. A pellet reactor is one widely used softening technology that may produce up to 350 kg calcium carbonate pellets per 1000 m<sup>3</sup> softened water. As of yet, no overview exists of how the physical and chemical properties of pellets are affected by operating conditions, such as placement in the water treatment train and which seeding material is used (quartz sand or calcium carbonate). The aim of this study was to characterize pellets formed under different operating conditions in pilot scale experiments at 8 Danish water treatment plants softening 16 water types. Results showed that iron concentrations, measured with ICP-MS, varied from 19 to 9,200 mg/kg and manganese varied from 0.5 to 980 mg/kg. The concentrations depended on both the raw water quality and the location of softening in the treatment train. Despite differences in chemical dosage, chemical composition of influent water, and seeding material, XRD analyzes showed that all pellets crystallized as calcite and have a relatively low reactivity of 7.4 to 26 % measured by the Sauerbeck & Rietz method. Our study showed that some pellet characteristics, e.g. the concentrations of iron and manganese, can be controlled in the design of the softening process. This allows for optimization of pellets with respect to environmentally sustainable reuse and ensure a pellet composition with high market value e.g. in markets such as glass or chemical industries. Our results assist the circular economy thinking in drinking water production.

