

# Optimization of the tableting process with respect to energy consumption

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# Presentation Agenda

- Why is it important?
- Tablet Manufacturing Process
- Experimental station and material
- Results
- Discussion



# Why is it important?

- manufacturing of pharmaceuticals represents one of the most carbon-intensive industries
- sustainable pharmaceutical manufacturing is characterized by reductions in
  - material consumption
  - energy requirement
  - waste generation
  - green house emission

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BELKHIR, L. - ELMELIGI, A. Carbon footprint of the global pharmaceutical industry and relative impact of its major players. In *Journal of Cleaner Production*. 2019. Vol. 214, p. 185–194.

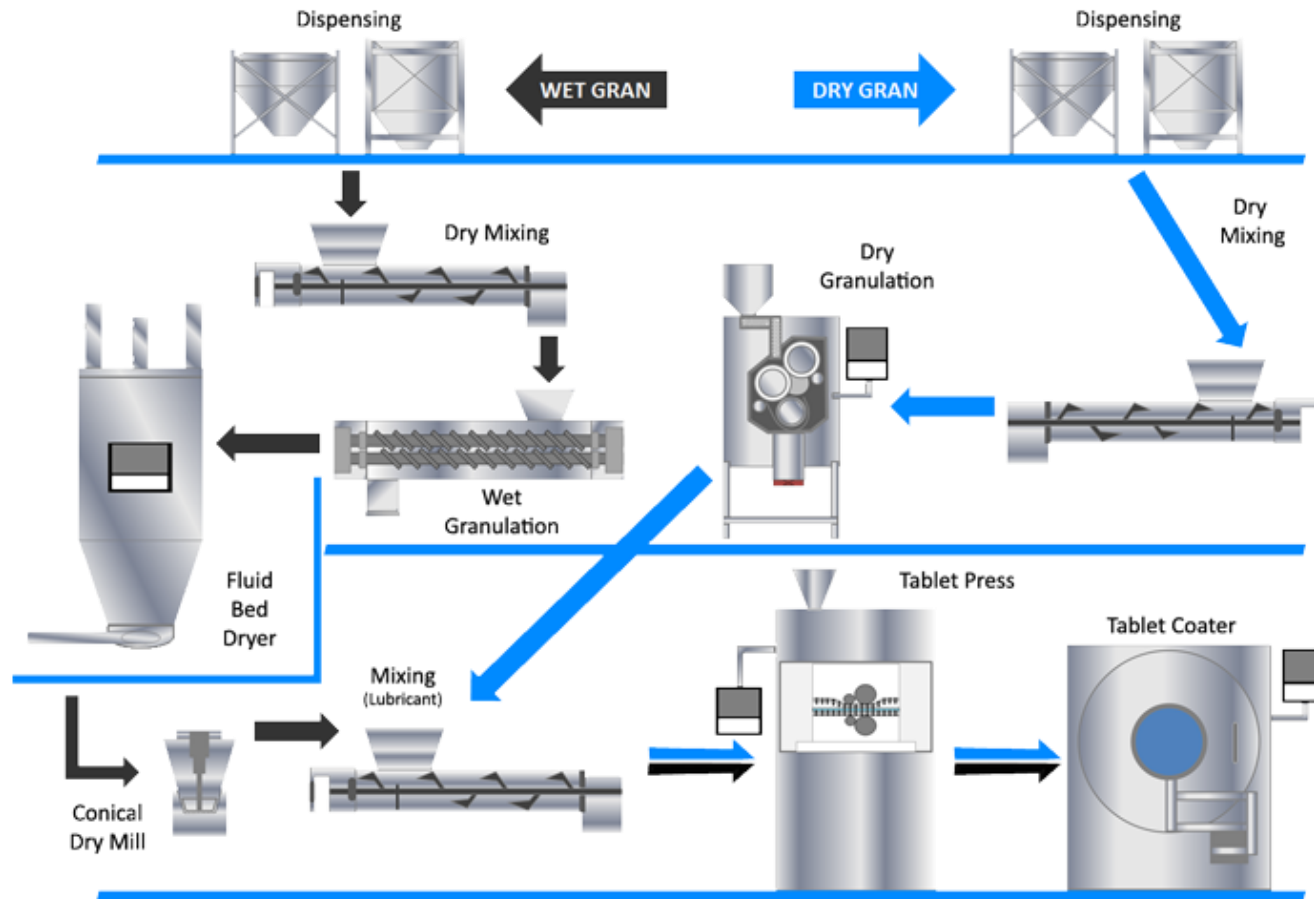
KOENIG, S.G. et al. Evaluating the Impact of a Decade of Funding from the Green Chemistry Institute Pharmaceutical Roundtable. In *Organic Process Research & Development*. 2018. Vol. 22, no. 10, p. 1344–1359.

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# Tablet Manufacturing Process



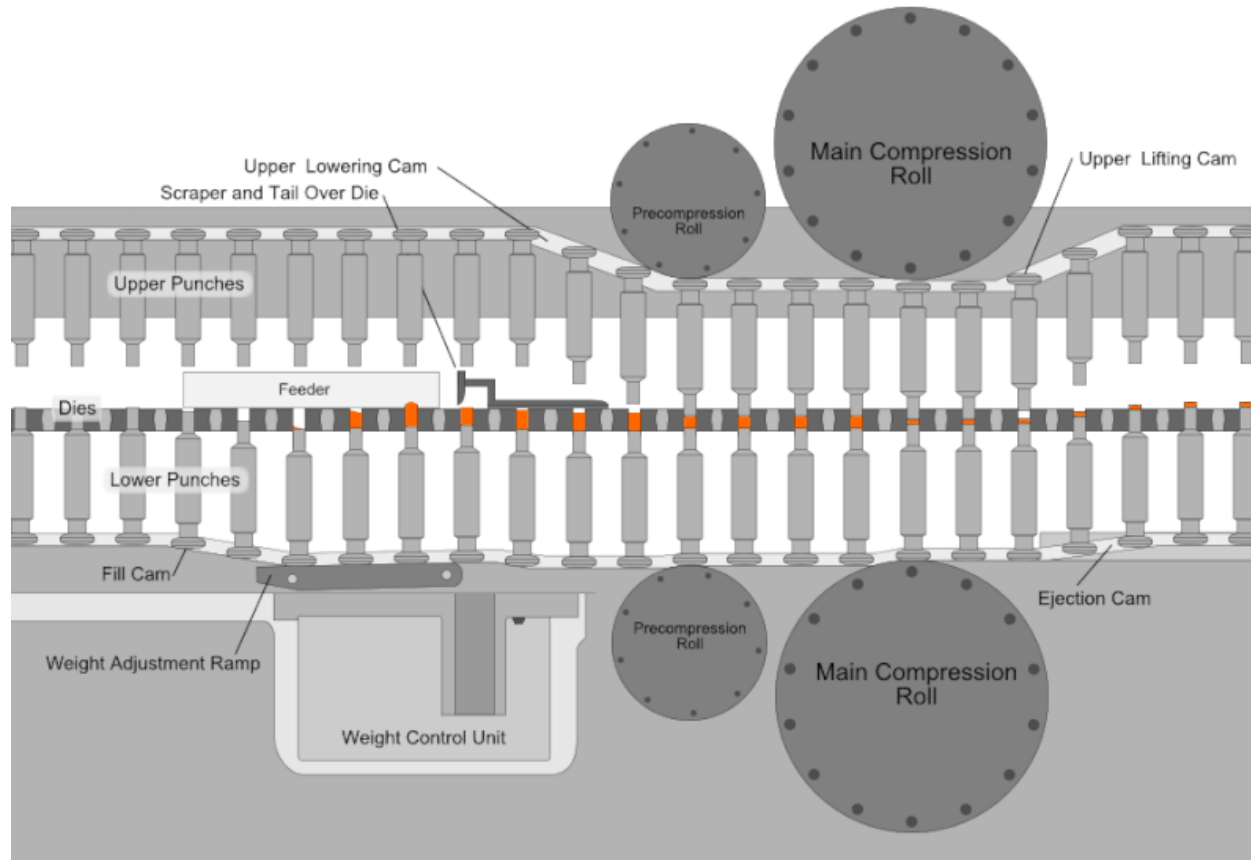
<http://www.pharmatips.in/Articles/Pharmaceutics/Tablet/Introduction-Of-Tablet-Manufacturing-Process.aspx>

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# Tablet Manufacturing Process



[https://en.wikipedia.org/wiki/Tablet\\_press](https://en.wikipedia.org/wiki/Tablet_press)



# Energy requirement

- a lot of excess energy is generated during tablet production
- most of this energy is converted into heat
- to determine this energy, it is necessary to know the temperature profile in the tablet during compression

$$\Delta E_C = W_C - Q_C$$

$$Q_C = C_p \Delta T$$

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# Water requirement

- every year, several million liters of drinking water are wasted in the pharmaceutical industry
- wastewater treatment is very energetically and financially demanding
- the most basic option is not to use water that you do not need to use

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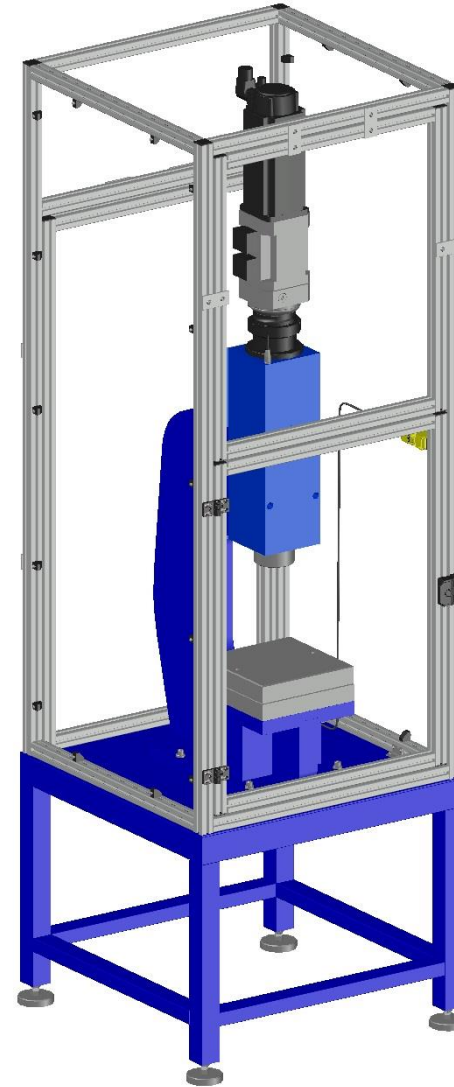
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# Experimental station

- electromechanical press Kistler NCFN 2153A
  - maximum compression force 60 kN
  - maximum compression speed 250 mm/s
  - integrated punch force and punch position sensors



<https://www.kistler.com/en/product/type-2153a/>





# Experimental station

- measuring system for experimental compression
  - designed at the Institute of Process Engineering
  - 3 force sensors
  - punch position sensor
  - thermocouple



# Experimental material

- Avicel - PH102 microcrystalline cellulose
  - one of the most used excipients in the pharmaceutical industry
  - very good flowability, compressibility and compatibility



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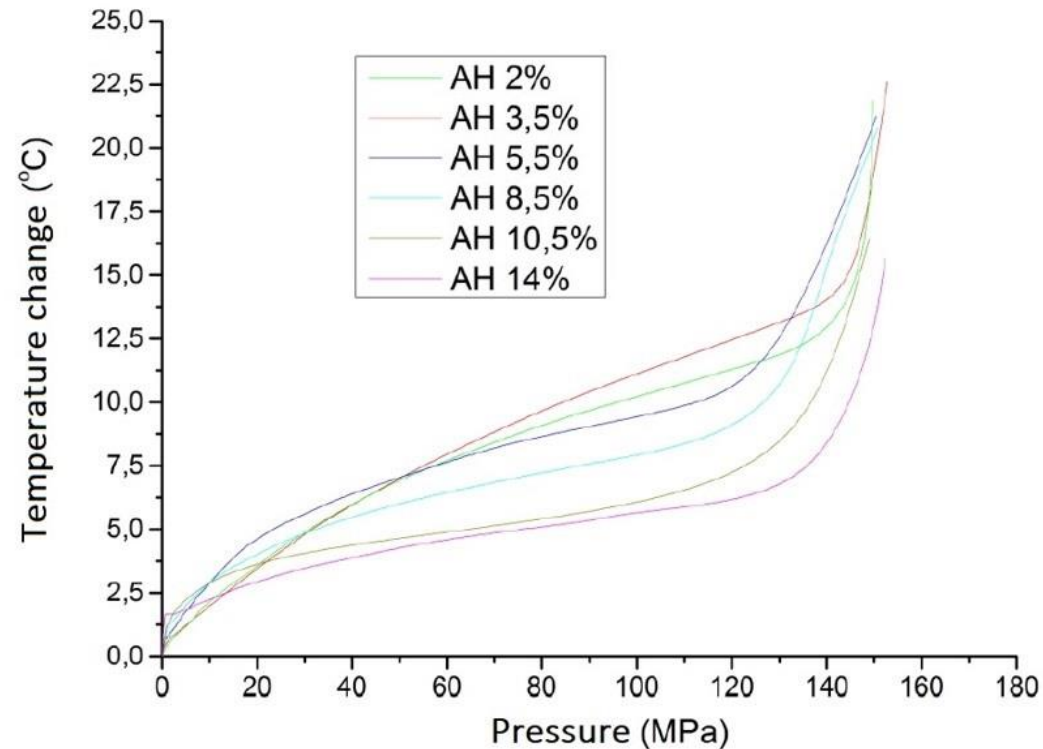
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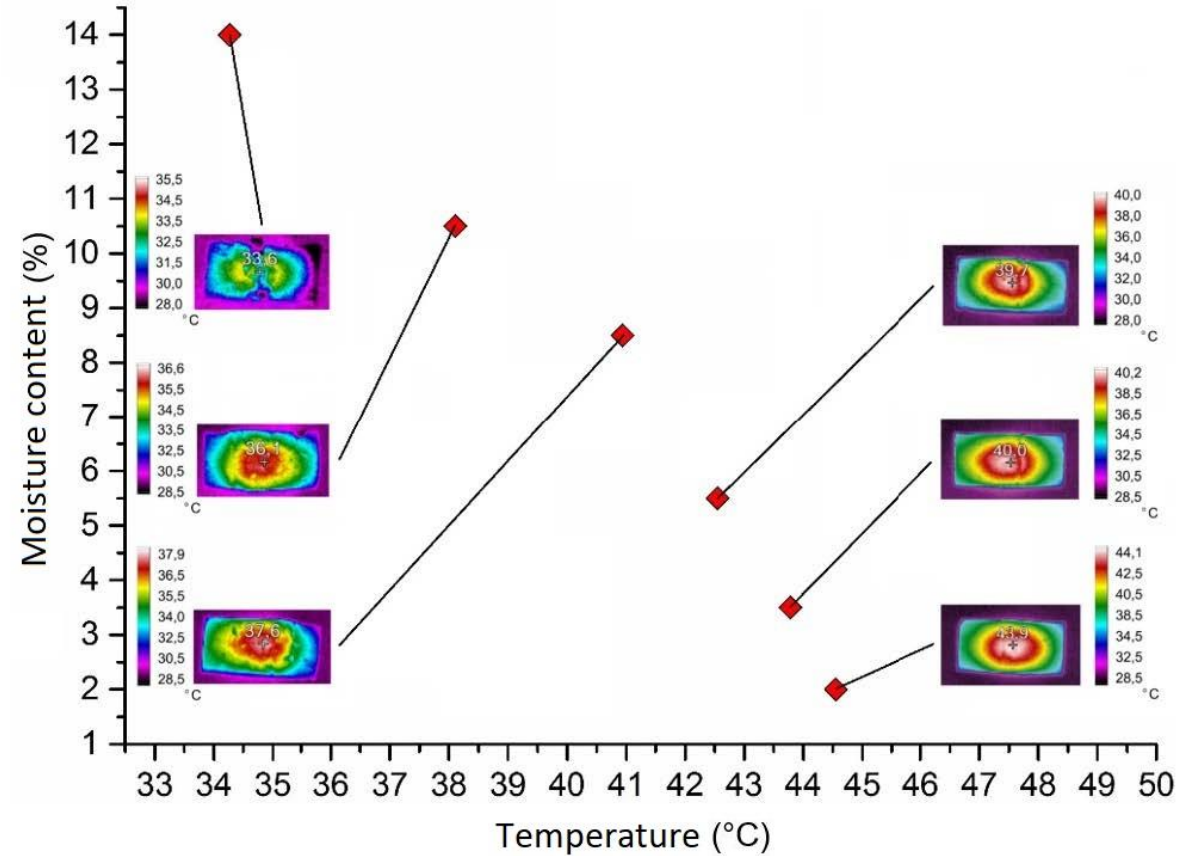


# Results

- temperature change during compression



# Results



Peciar, P. et al.: Unique measuring system for thermomechanical analysis of tableting process. In: Granulation Conference : 8th International Granulation Workshop, Sheffield, UK. 2017.

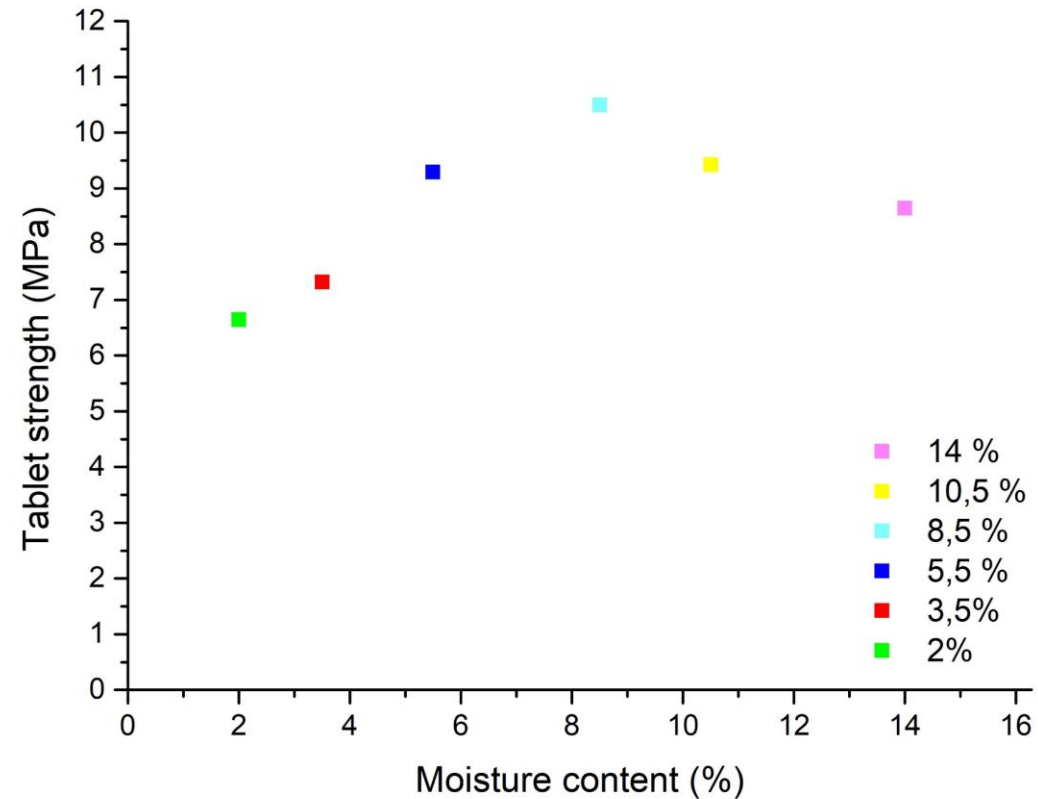
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# Results

- tablet strength depending on moisture content



# Acknowledgment

- Visegrad Fund

CCUV4 - Green Deal strategies for V4 countries:  
The needs and challenges to reach low-carbon industry.

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- Visegrad Fund
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**Thank you for your attention.**

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