SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA
FACULTY OF MECHANICAL ENGINEERING
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OPTIMIZATION OF THE EXTRUSION PROCESS WITH RESPECT TO ENERGY CONSUPTION

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CCUV4 - Green Deal strategies for V4 countries:
The needs and challenges to reach low-carbon industry.
The CCUV4 Workshop No.2 – 31.05.2023, Lodz
The project is supported by The International Visegrad Fund, project ID22120032.

Paste Extrusion

- powder + liquid ➡ paste
- extruder = barrel + matrix (die) + piston or screw
- rheological properties – mostly Non - Newtonian fluids
- not all pastes have suitable rheological properties:
  - Main problem ➡ liquid migration and quality of product surf
  - Additives for their improving ➡ influence on the final produc
  - Extruder with special design ➡ rate of shear strain in front o

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Paste reduction between barrel and die

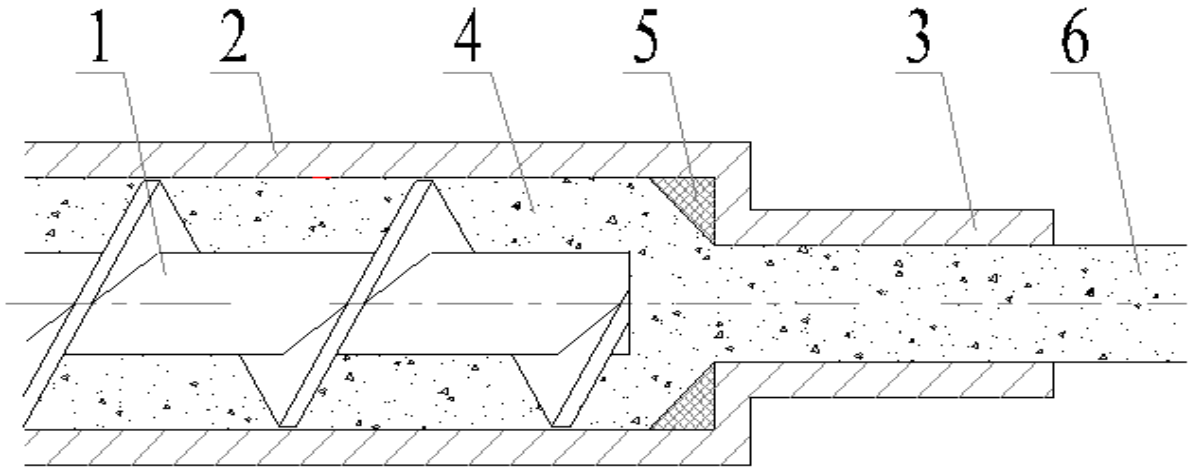

Fig.1 Screw extruder:
1. screw/piston, 2. barrel, 3. die, 4. paste, 5. product.

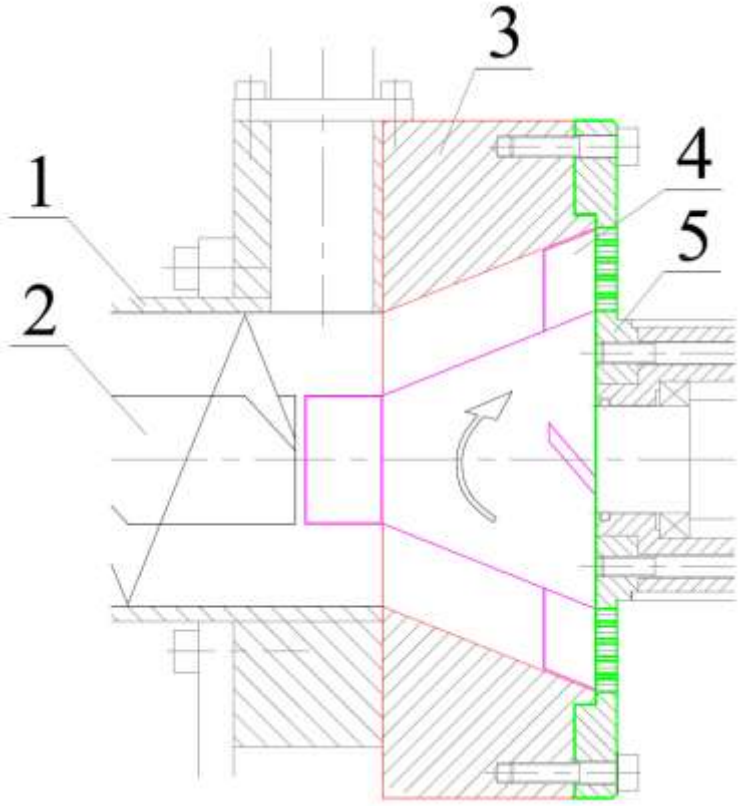

Fig.2 Extruder with rotor:
1. barrel, 2. screw, 3. cone head, 4. rotor with blades, 5. matrix.

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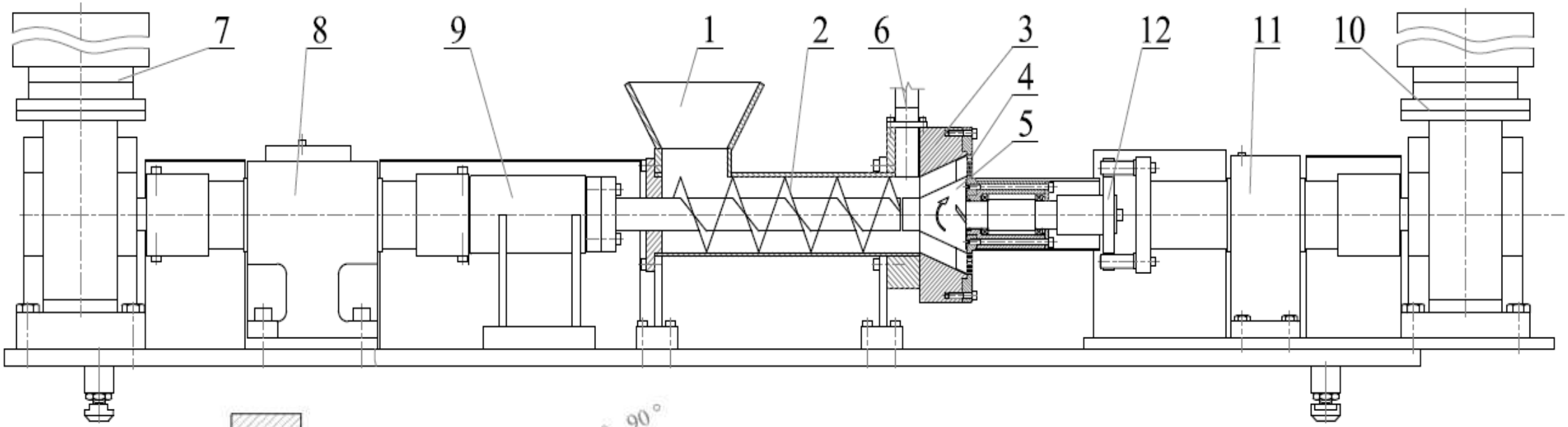
Extruder with the independent screw and rotor drive



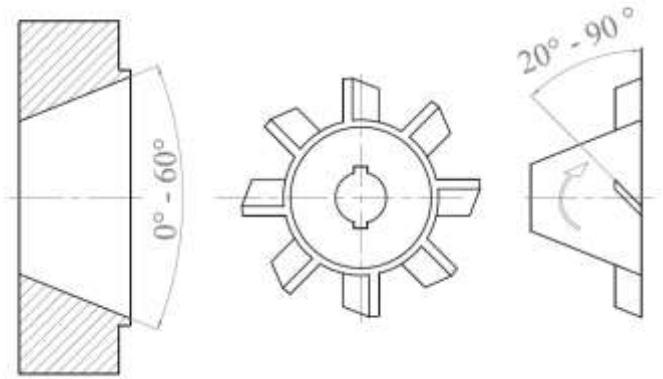


Fig.3 Extruder with rotor:
1. barrel, 2. screw, 3. cone head, 4. matrix, 5. rotor with blades, 6. pressure sensor, 7. drive for screw, 8. sensor of torque for screw, 9. bearing housing, 10. drive for rotor, 11. sensor of torque for rotor, 12. flexible coupler

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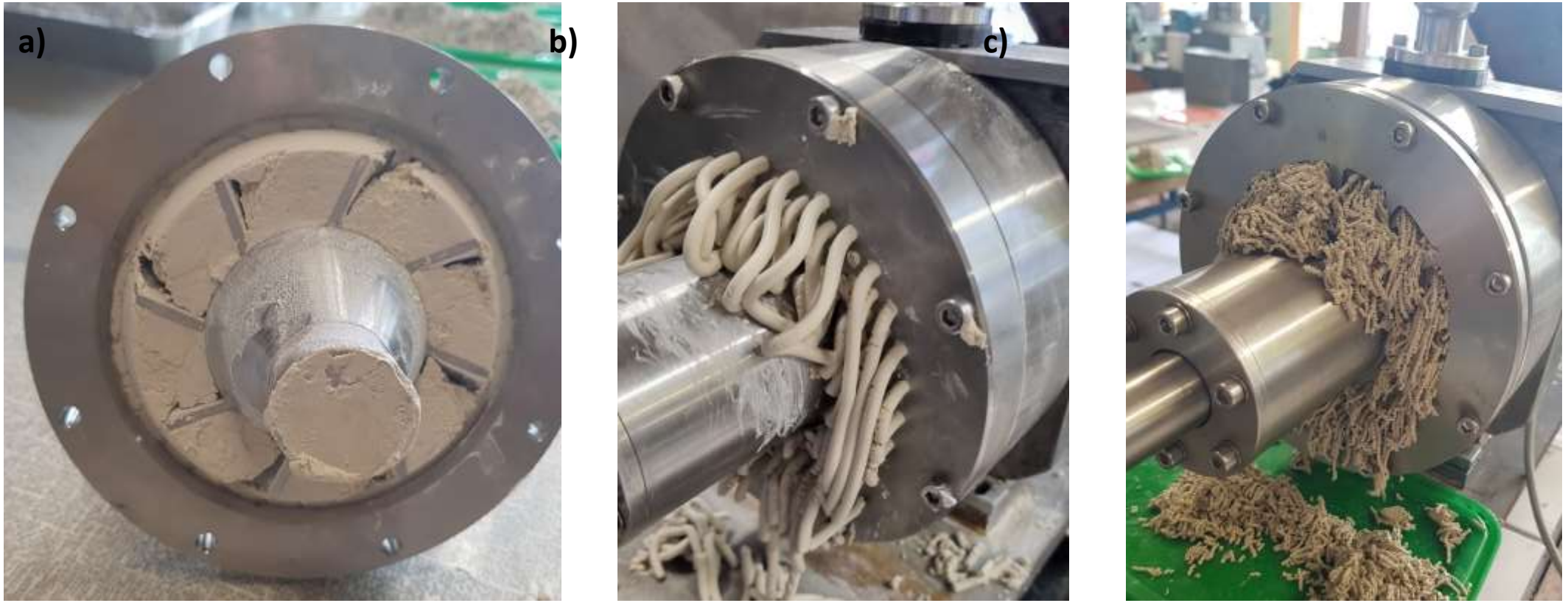

Fig.4 Detail of the extruder with rotor:
a) detail of rotor and paste, b) extrusion through the matrix with cylidrical holes,
c) extrusion through the wire sieve matrix.

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Influence of the rotor speed on the extrusion pressure

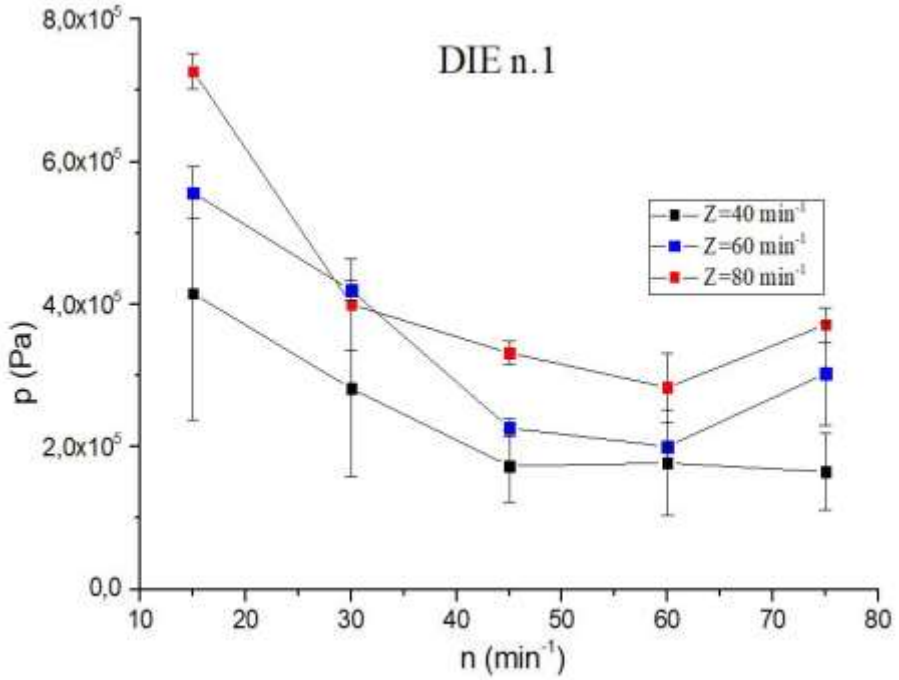

Fig.5 Extrusion pressure as the funcion of rotor speed, parameter speed of screw, die L/D = 5 mm / 4 mm.

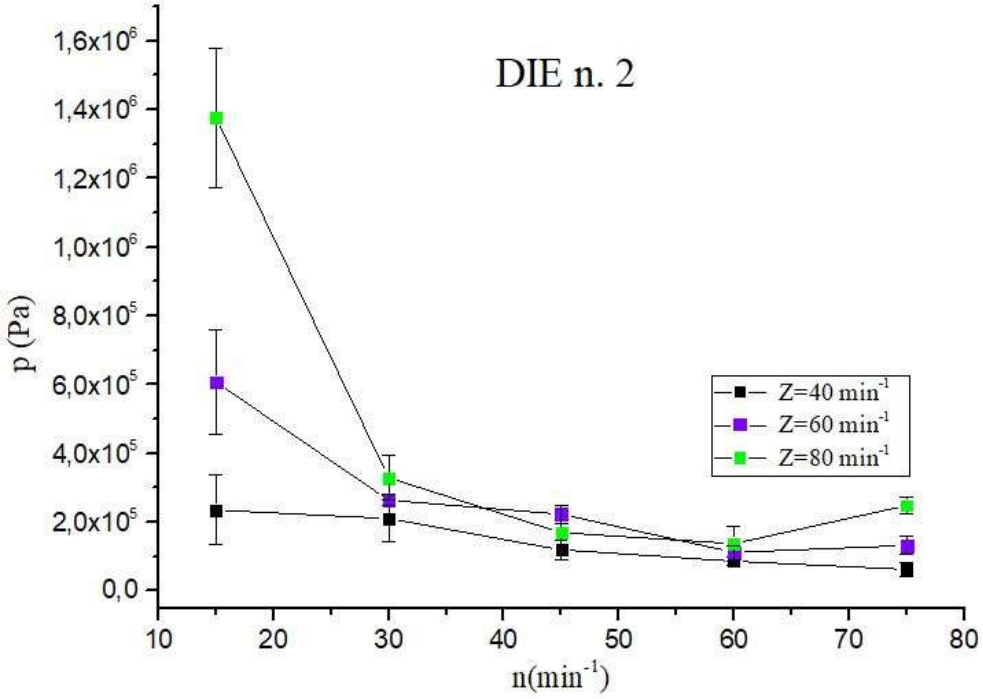

Fig.6 Extrusion pressure as funcion of rotor speed, parameter speed of screw, die L/D = 9 mm / 4 mm.

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Rotor speed 15 min^{-1}

Z= 40 min^{-1}

Z= 60 min^{-1}

Z= 80 min^{-1}

Rotor speed 75 min^{-1}

Fig.7 Influence of the screw and rotor speed and die geometry L/D = 5 mm / 4 mm on the product quality.

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Rotor speed 15 min^{-1}

Z= 40 min^{-1}

Z= 60 min^{-1}

Z= 80 min^{-1}

Rotor speed 75 min^{-1}

Fig.8 Influence of the screw and rotor speed and die geometry L/D = 9 mm / 4 mm on the product quality.

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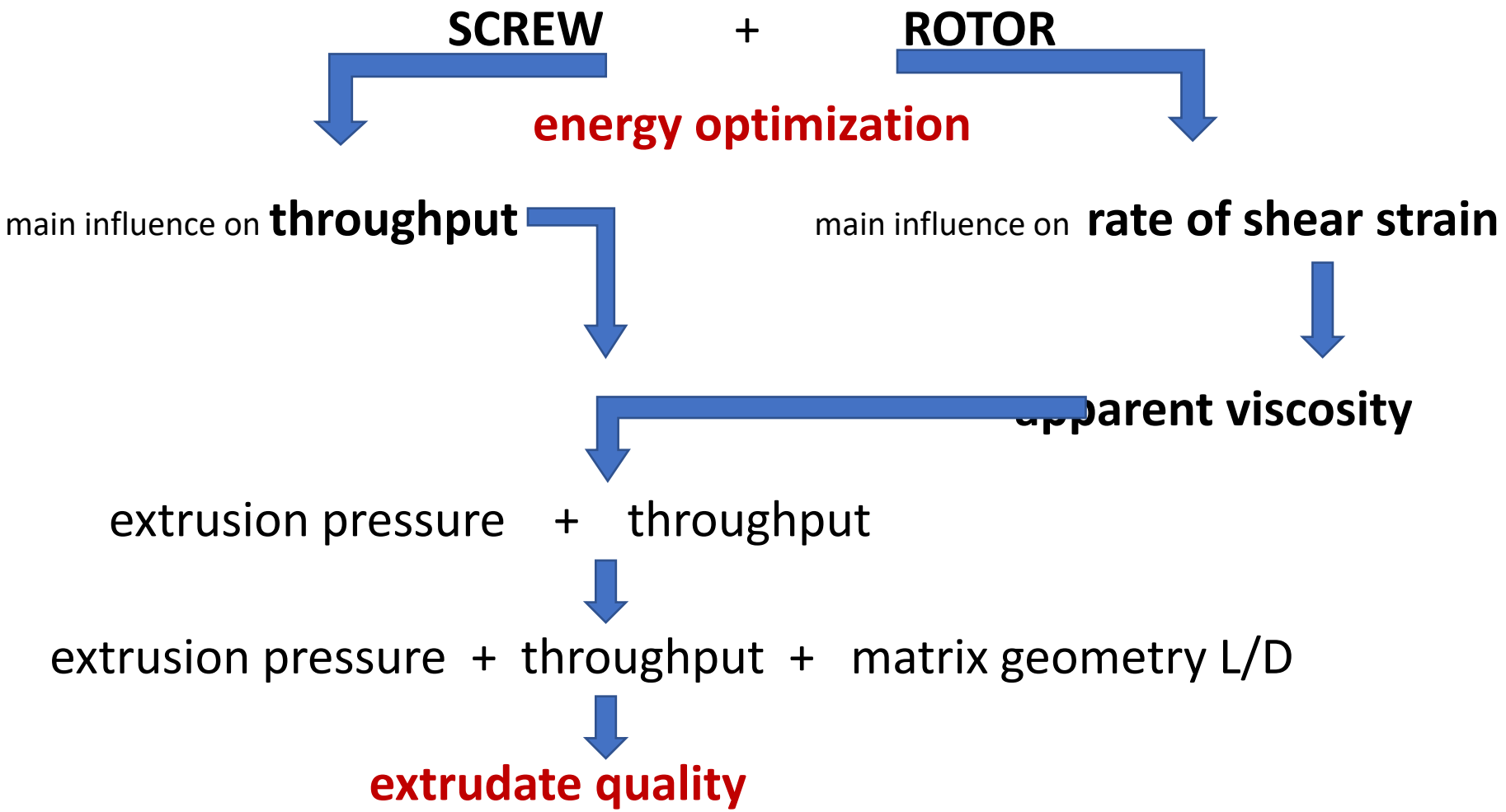
Conclusion



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Thank you for your attention

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