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# What happens to peat during bog fires: Thermal transformation processes of peat organic matter and possible impacts of it

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# Content



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# Bog fires globally and in Latvia

- Serious natural phenomenon – dimensions, frequency and volume.
- Complications – pollution, health, destruction of ecosystems, landscapes and resources.
- More than 40 cases in Latvia from 2011 till 2018.
- Fire affected territories in Latvia in most cases are not significant.
- Main cause – Human activity.
- Aim of the study – analyze impacts of bog fires on peat

**WHAT HAPPENS TO PEAT DURING BOG FIRES?**

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# Materials and Methods

## SAMPLES AND THERMAL TREATMENT

- Main samples:

| Natural peat (NP) | Coked peat (CP) |
|---|---|

- Thermally treated samples:

| 150 °C | 225 °C | 300 °C | 375 °C |
|---|---|---|---|

## METHODS

- Scanning electron microscopy (SEM),
- Thermogravimetric analysis (TGA),
- Characterization:

| pH | Electrical conductivity | Total dissolved solids | Lipids | Total organic carbon | Humic substances |
|---|---|---|---|---|---|

- Excitation emission matrix – fluorescence spectroscopy

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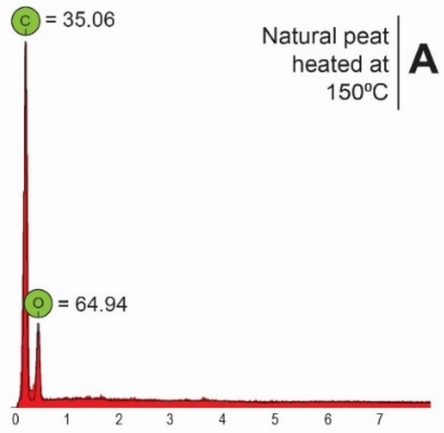
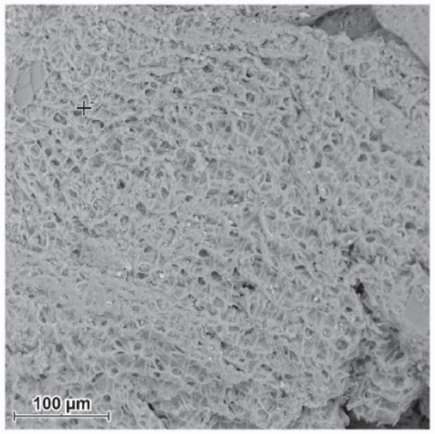
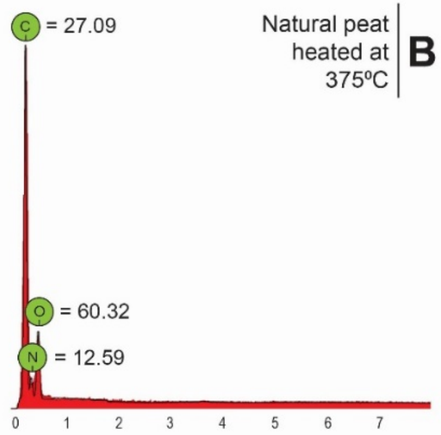
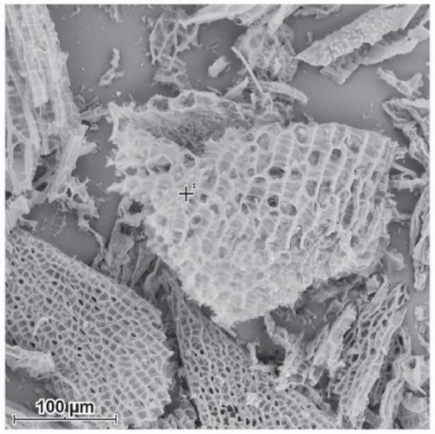


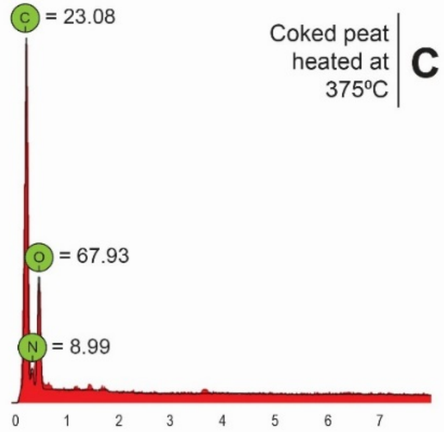

Natural peat heated at 150°C **A**



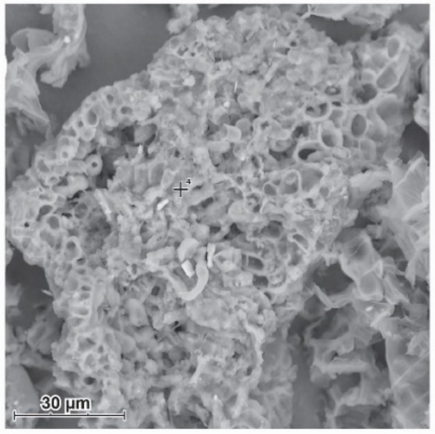




Natural peat heated at 375°C **B**




Coked peat heated at 375°C **C**




- The pores are **partially retained at 375 °C**
- In **charred peat** structure and pores are damaged
- Oxygen does not vary significantly with **thermal treatment**
- Carbon decreases with **thermal decomposition**

# Scanning electron microscopy

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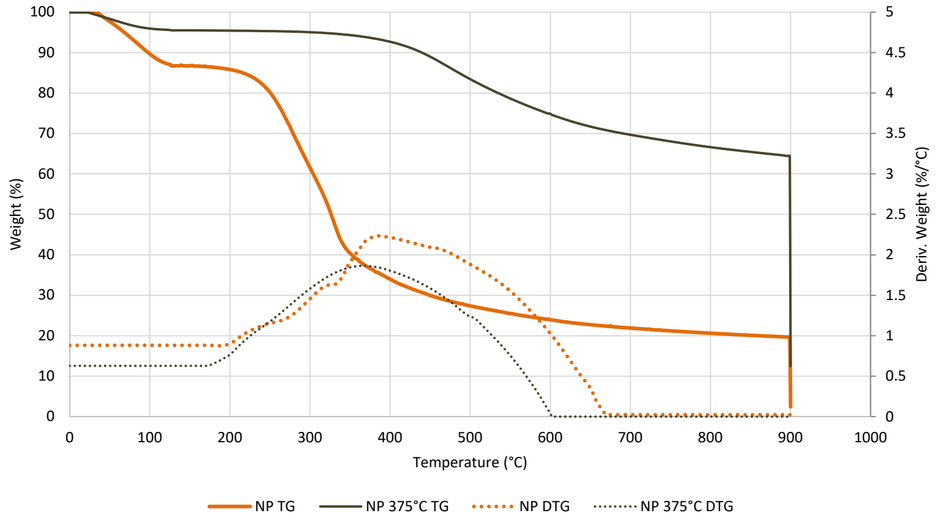
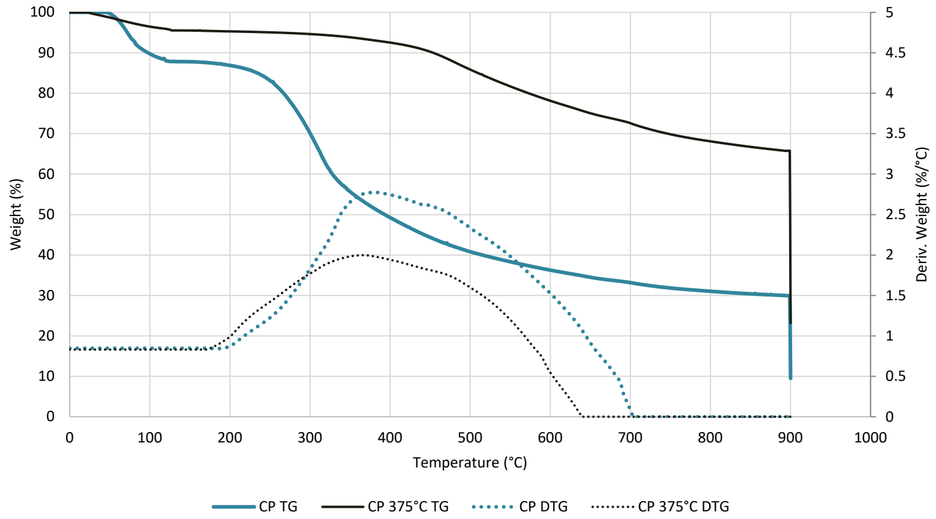
# Thermo-gravimetric analysis




- Thermal destruction takes place between **200°C** and **300°C**.
- Destructive drying **increases hydrophobicity**.
- **Water uptake decreases** two times after thermal treatment.
- Thermal decomposition of NP and CP are **quite similar**.

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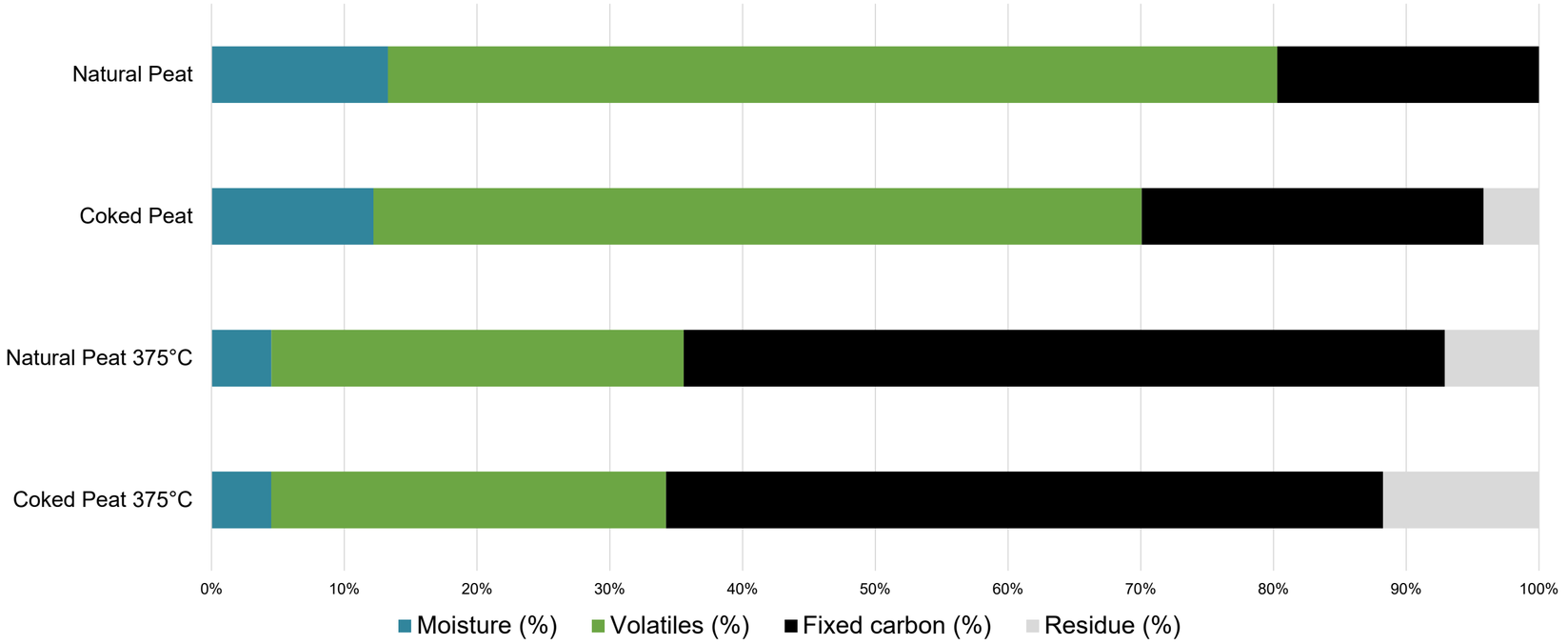
# Proximate analysis




- **Pyrolitic decomposition or Torrefaction** in deeper layers.
- Differences in peat mass only occurs **after thermal treatment**.
- Pyrolysis process involves production of **fixed carbon**.

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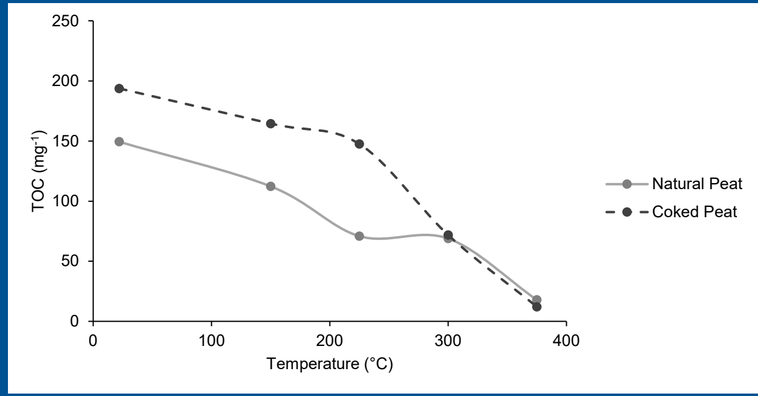
# Peat characterization

| PEAT SAMPLE | CHARACTERISTICS | | | | | | |
|---|---|---|---|---|---|---|---|
| | pH | TDS, ppm | σ, μS/cm | TOC, mg/g | $W_{HA}$, % | $W_{FA,\ TOC}$, % | $W_{lipids}$, % |
| Coked Peat (CP) | 4.50 | 55.9 | 110.0 | 193.7 | 79.1 | 20.9 | 1.23 |
| Natural Peat (NP) | 4.97 | 43.8 | 86.9 | 149.4 | 70.2 | 29.8 | 1.15 |
| NP 150° C | 5.10 | 25.6 | 51.3 | 112.3 | 60.8 | 39.2 | 1.33 |
| NP 225° C | 5.00 | 38.3 | 72.2 | 70.9 | 60.2 | 39.8 | 1.85 |
| NP 300° C | 5.06 | 34.6 | 70.6 | 68.9 | 52.8 | 47.2 | 2.30 |
| NP 375° C | 6.28 | 15.2 | 31.4 | 17.8 | 52.4 | 47.6 | 1.95 |
| CP 150° C | 4.56 | 50.9 | 101.2 | 164.5 | 75.0 | 25.0 | 1.45 |
| CP 225° C | 4.58 | 60.4 | 111.4 | 147.5 | 71.1 | 28.9 | 2.50 |
| CP 300° C | 5.28 | 27.6 | 63.4 | 71.8 | 48.7 | 51.3 | 3.20 |
| CP 375° C | 5.37 | 17.0 | 35.0 | 12.1 | 47.9 | 52.1 | 2.80 |

- **pH and mineral matter increase** with thermal decomposition
- Thermal treatment causes **decrease in humic acids** and **increase in fulvic acids**




Humic substances in peat expressed as total organic carbon concentration

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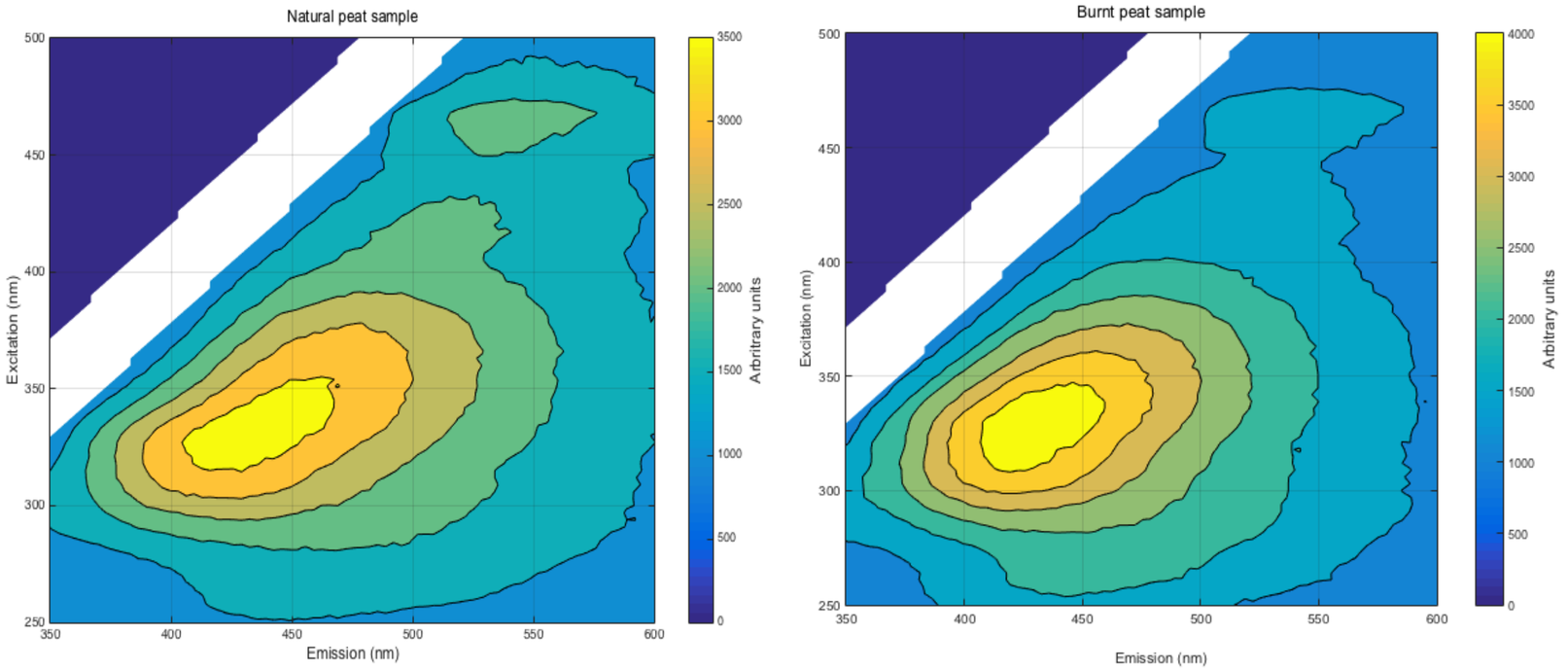


# Excitation emission matrices

- Charred HS fluorescence emerges in relative intensity.
- Prolonged heat impact results in **increment of aromatic structures.**
- Model reveals **severe physical and chemical changes to HS** due to peatland fire

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# Conclusions

- Thermal decomposition may result in **loss of peat absorption properties**.
- **Mineral substances** (inorganic ions) after bog fires can **leak out from the peat**.
- Burned peat could be **beneficial for production** of growth substrates.
- Peat fires can **support development of higher vegetation**.

**The Bog Fires result in significant changes of peat properties**

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Dabas aizsardzības pārvalde

# Thank you for the attention

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