

A novel method for the extraction and measurement of hydroxylamine (NH₂OH) in soils

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← 1 Background

Hi! What is hydroxylamine?

It is a nitrification intermediate and involved in abiotic N₂O production¹.

Why do we want to measure it in soils?

Because it will help us to understand the role of nitrification and abiotic reactions for soil N₂O emissions.

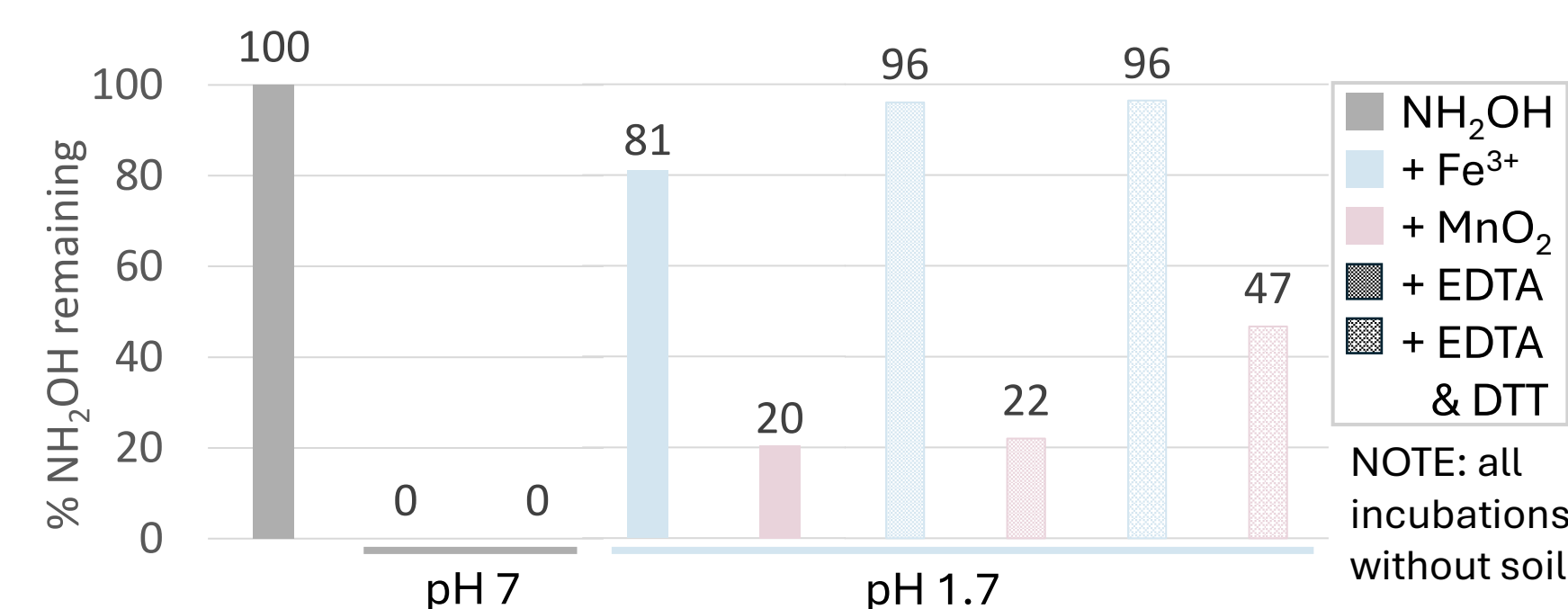
Why do we need a new method for this?

The only published extraction protocol² only works for a narrow range of soil types and does not achieve high recoveries.

Why is NH₂OH lost during the extraction?

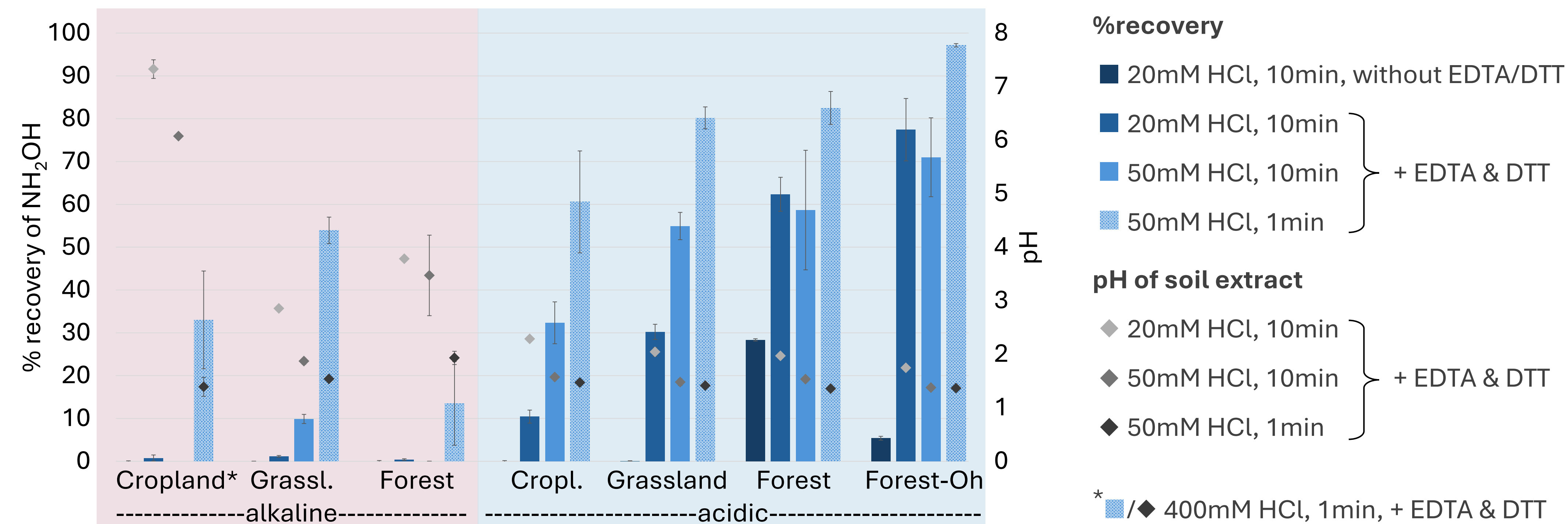
It abiotically reacts with Fe³⁺ and MnO₂ in the soil.

Can we block the reaction with Fe₃⁺ and MnO₂?

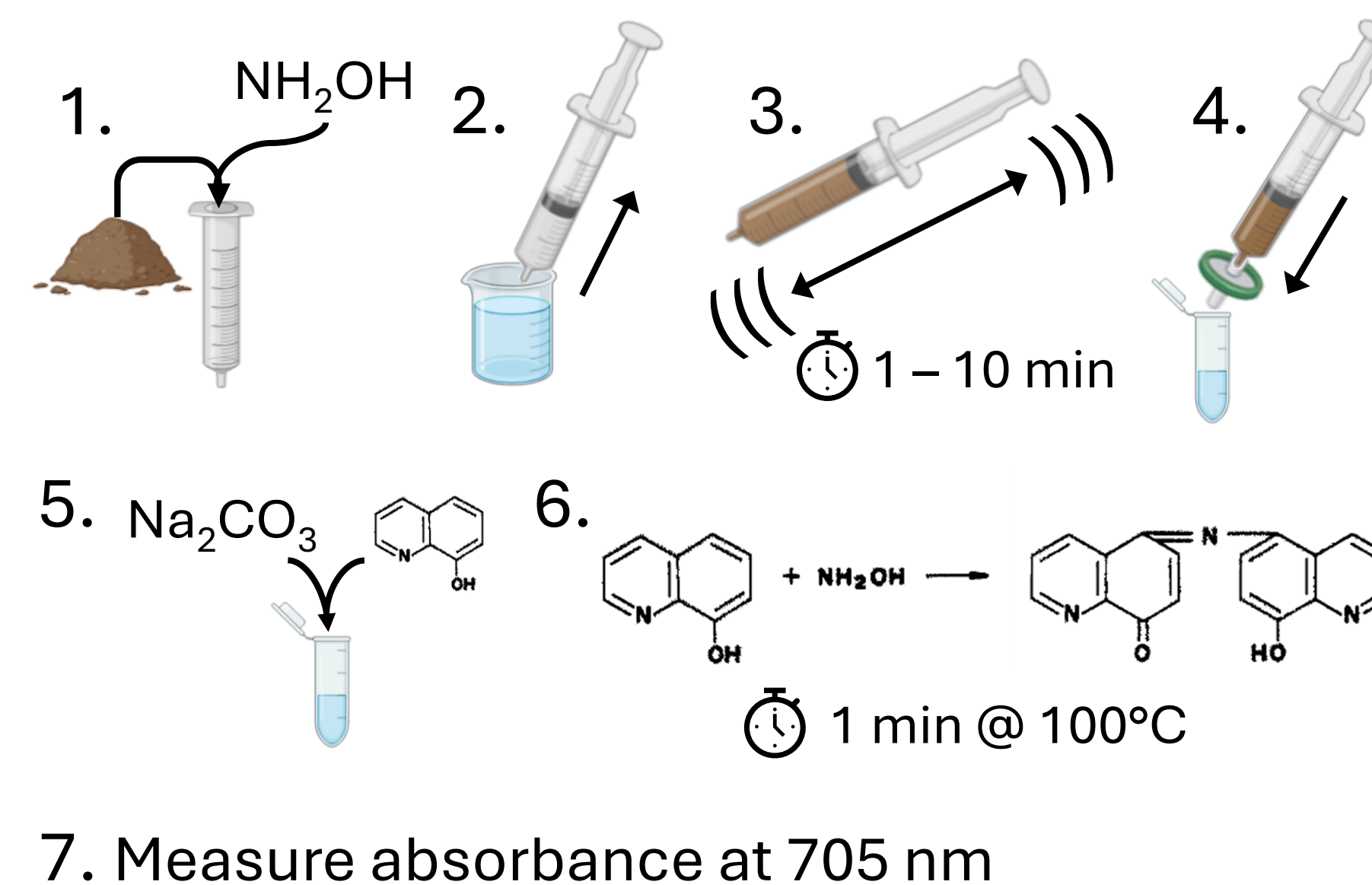


Yes, at least partially with EDTA and DTT at low pH.

3 Results: NH₂OH extraction efficiency



2 Materials & Methods



4 Conclusions

So, what do we need for a successful NH₂OH extraction?

You need a chelator (EDTA) and reducing agent (DTT), short extraction times (1min) and pH < 2 in the extract.

Is the extraction efficiency the same in all soils?

No, it is lower in CaCO₃-containing than in acidic soils.

To quantify soil NH₂OH contents you need to assess the extraction efficiency for each soil by spiking a known amount of NH₂OH.

5 Outlook

What will you do next?

1. Purify and concentrate the derivatization product via solid phase extraction.
2. Measure its concentration and ¹⁵N-enrichment via high resolution MS.
3. Apply the method in ¹⁵N-tracing studies.

References:

- ¹ Heil, Jannis, Harry Vereecken, and Nicolas Brüggemann. 2016. "A Review of Chemical Reactions of Nitrification Intermediates and Their Role in Nitrogen Cycling and Nitrogen Trace Gas Formation in Soil." *European Journal of Soil Science* 67 (1): 23–39.
- ² Liu, Shurong, Harry Vereecken, and Nicolas Brüggemann. 2014. "A Highly Sensitive Method for the Determination of Hydroxylamine in Soils." *Geoderma* 232–234 (November): 117–22.
- Derivatization reaction:
 Berg, Richard, and Erna Becker. 1940. "Ein Neuer Nachweis von Hydroxylamin Durch Bildung von Chinolinchinon-(5.8)-[8-Oxy-Chinoly 5-Imid]- (5), Genannt „Indo-Oxin”." *Berichte Der Deutschen Chemischen Gesellschaft (A and B Series)* 73 (3): 172–73.
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