



Leader in flour applications.

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Annette Büter

Technical Applications Manager - Flour Fortification

Mühlenchemie GmbH & Co. KG

Ahrensburg, Germany

Ein Unternehmen der
Stern-Wywiol Gruppe



Agenda



- Introduction to iron
- Interactions of iron
 - with flour improvers
 - on bread crust
- Recommended Storage of micronutrients



Introduction to iron

Introduction to iron – iron compounds



Iron, electrolytic



Ferrous fumarate

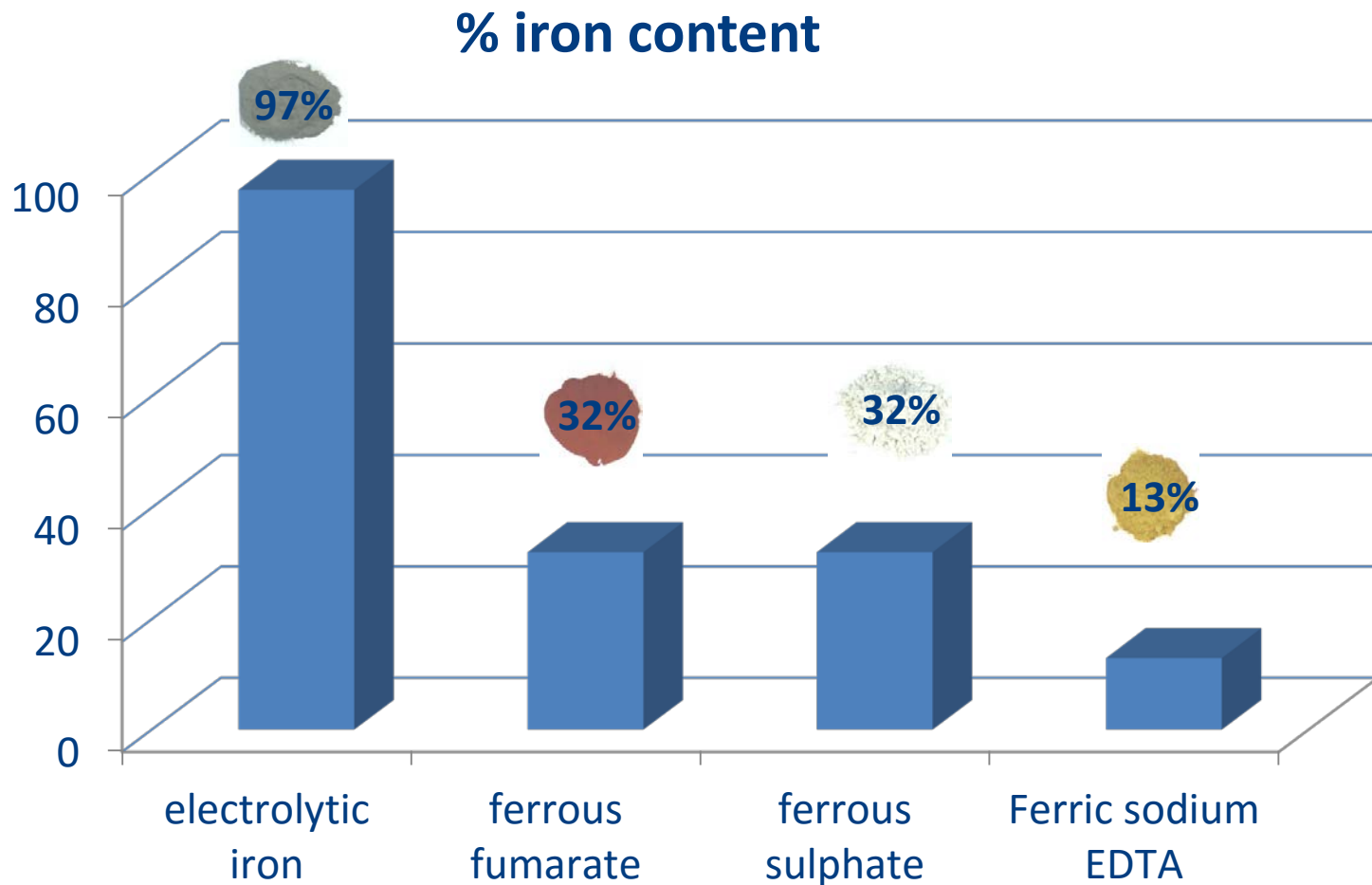


Ferric sodium EDTA



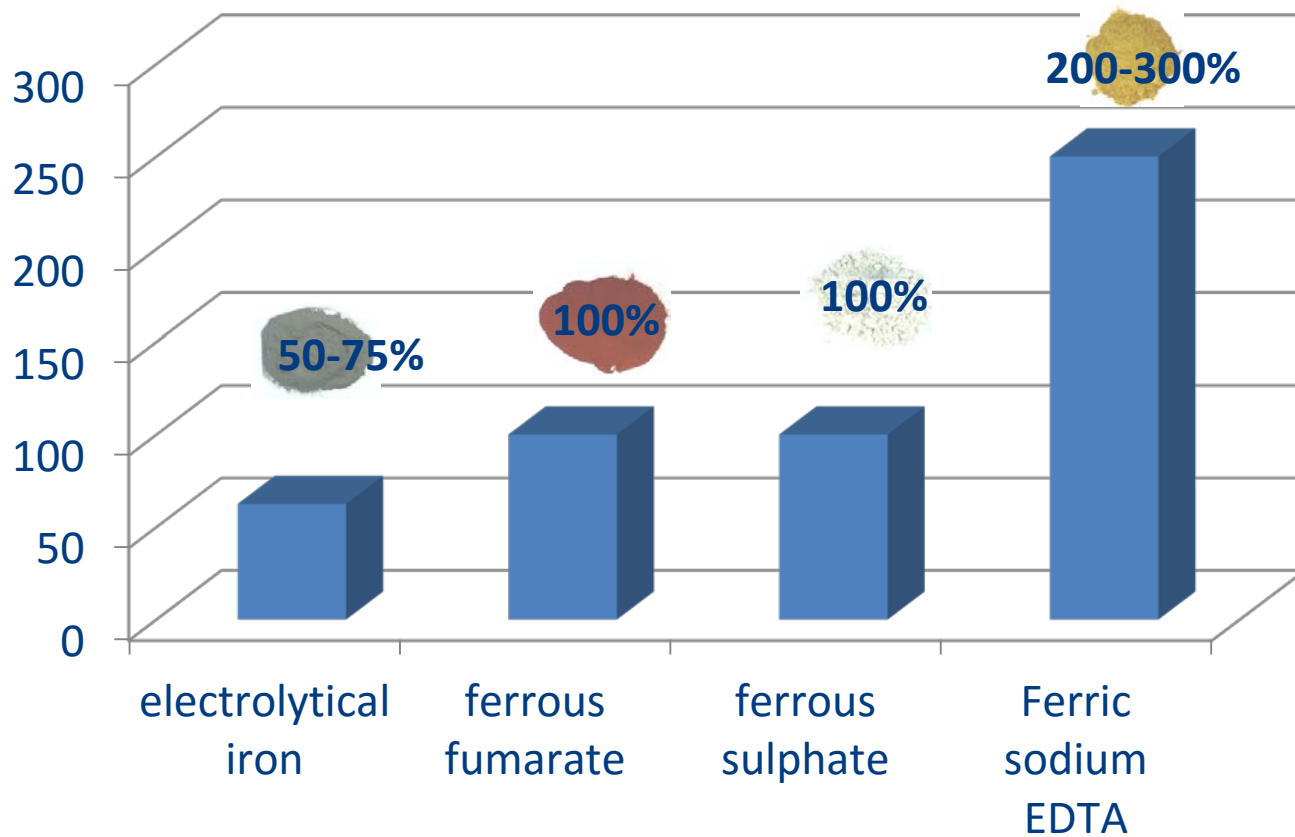
Ferrous sulphate

Introduction to iron – iron compounds



Introduction to iron – iron compounds

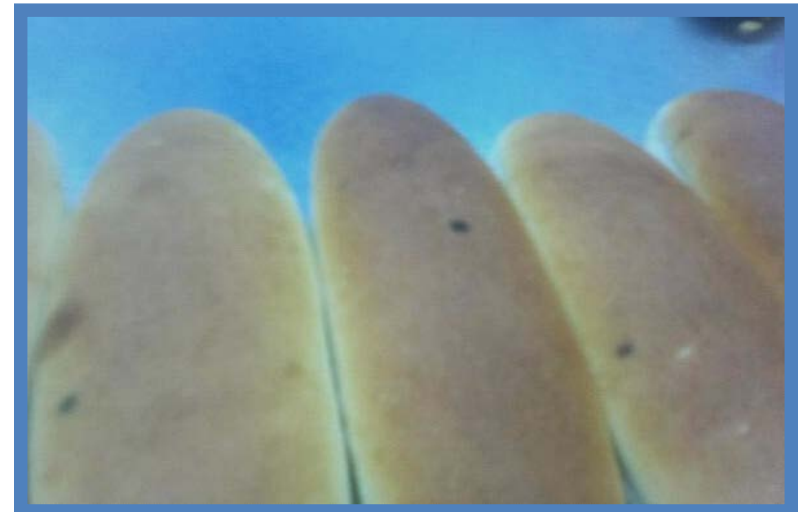
% bioavailability





Interactions with iron

Interactions with iron





Interactions with iron & flour improvers

Interaction between flour improvers and fortificants

Ascorbic acid and iron - Testing

	Mix 0	Mix 1	Mix 2	Mix 3	Mix 4
Ascorbic acid	100 ppm	100 ppm	100 ppm	100 ppm	100 ppm
Ferric sodium EDTA		40 ppm			
Ferrous sulfate			60 ppm		
Ferrous fumarate				60 ppm	
Electrolytic iron					120 ppm

Dosage ascorbic acid: average amount

Dosage iron: WHO recommendation

Storage conditions: 25°C / 50% r.H. (moderate)

30°C / 80% r.H. (tropical)

Interaction between flour improvers and fortificants

Ascorbic acid and iron - Results

Start of trials



Interaction between flour improvers and fortificants

Ascorbic acid and iron - Results

24h – 25°C / 50% r.H. (moderate)



Interaction between flour improvers and fortificants

Ascorbic acid and iron - Results

24h – 30°C / 80% r.H. (tropical)



Interaction between flour improvers and fortificants

Ascorbic acid and iron - Conclusion

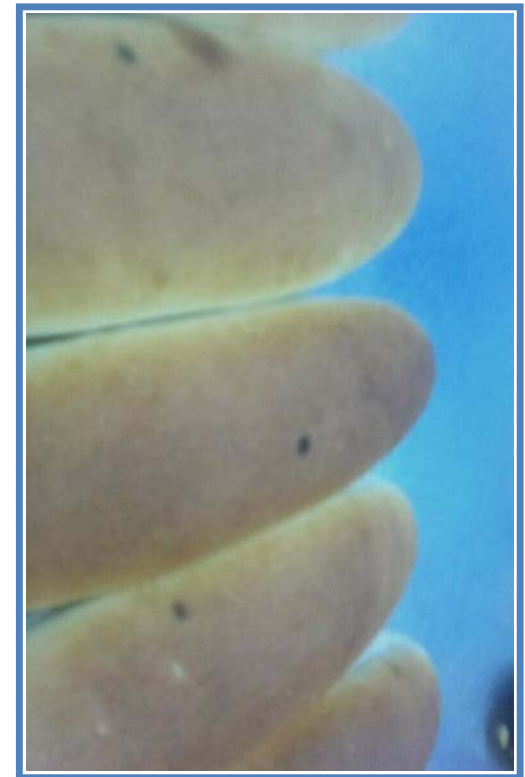
- **At tropical conditions**
 - NOT recommended to mix ascorbic acid and iron (vitamin/mineral premix) before adding to flour
- **At moderate conditions**
 - Mixing vitamin/mineral premix with ascorbic acid seems possible.
 - Nevertheless, ascorbic acid degradation should be analysed



Interactions with iron on bread crust

Interactions with iron – Spots on bread

- **Initial data**
 - Customer used ELCOvit 2035 RCH
 - Dosage: 200 ppm, thereof 30 ppm iron from ferrous sulfate
- **Discussion**
 - Coarse ferrous sulfate can cause spots on bread crust



Interactions with iron – Spots on bread

- Formation of dark spots by a too coarse ferrous sulphate powder

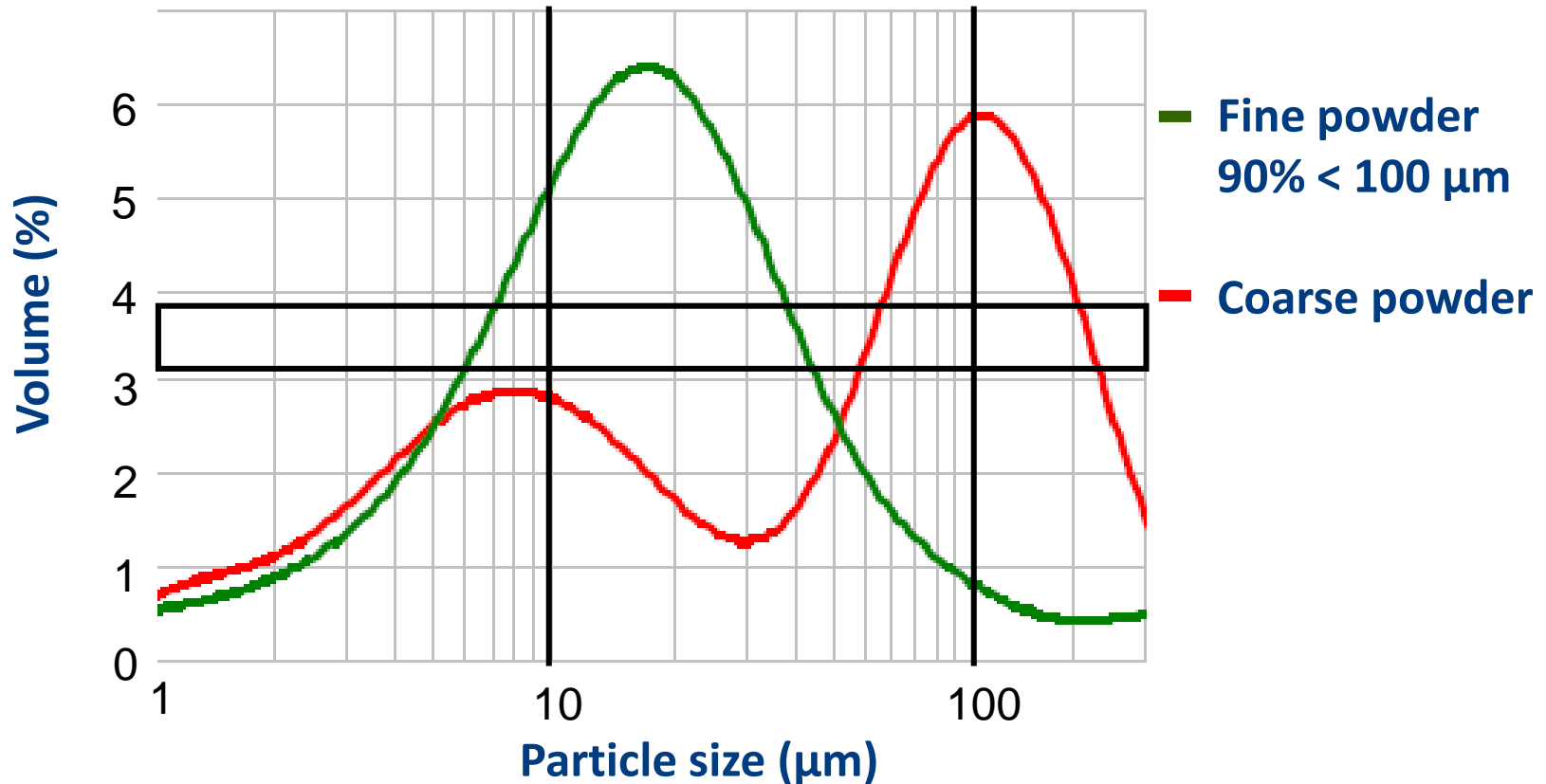


Fine powder

Coarse powder

Interactions with iron – Spots on bread

- Different particles sizes of ferrous sulphate powder



Interactions with iron – Spots on bread

- **Discussion**

- Coarse ferrous sulfate can cause spots on bread crust
- But granulation in all our premixes is fine (90% < 100 µm)
- Batch was also delivered to other mills, but this was the 1st and only claim

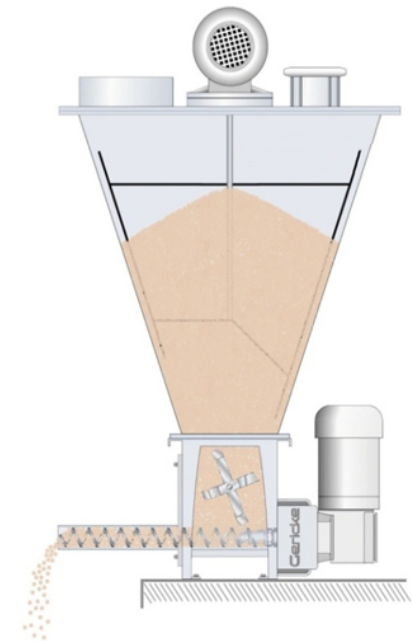
Interactions with iron – Spots on bread

- **Cause**

- Premix was kept in the feeder under humid conditions over a long period
- Agglomerates were formed

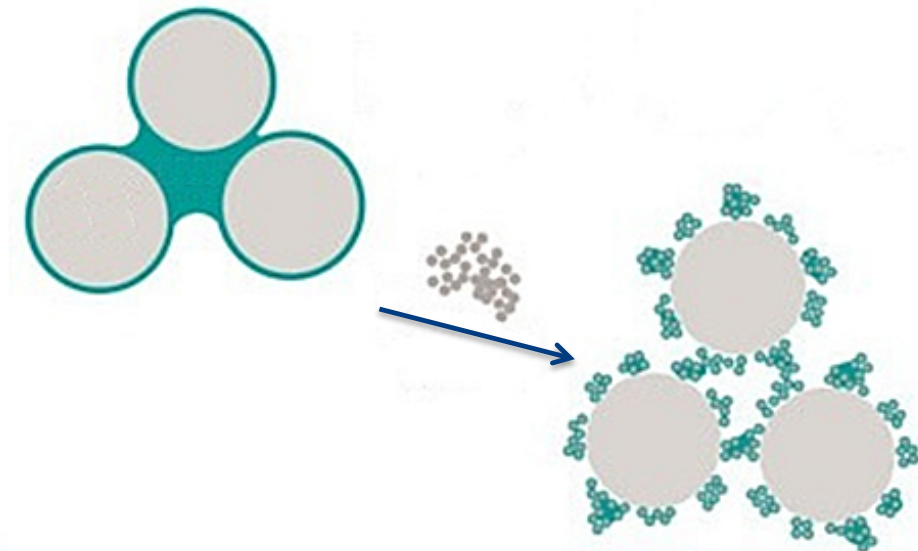
- **Action**

- Sieving of flour
- Increase of free flowing agent in our premix



Interactions with iron – Spots on bread

- **Free flowing agents – Function**
 - Extremely fine particles (SiO_2 : $\varnothing 13\text{-}20\ \mu\text{m}$)
 - Absorption of humidity
 - Keeps particles at a distance





Storage conditions

Micronutrient premixes need low humidity

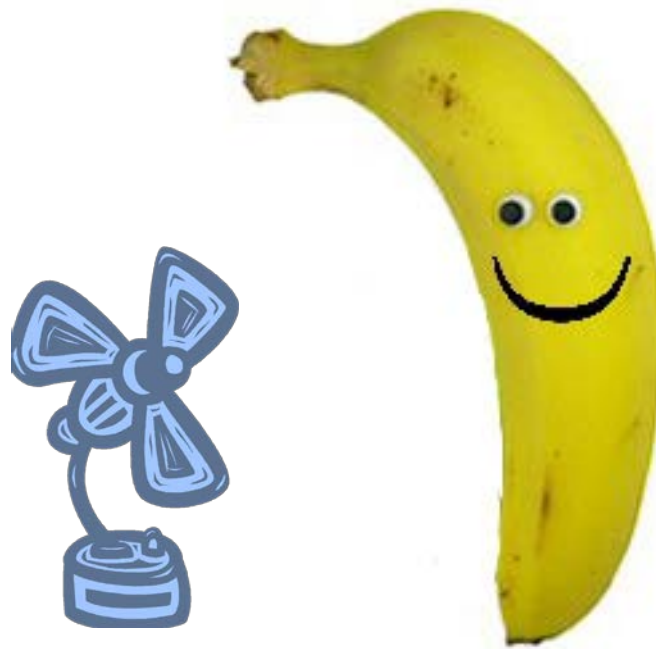


In humid conditions...

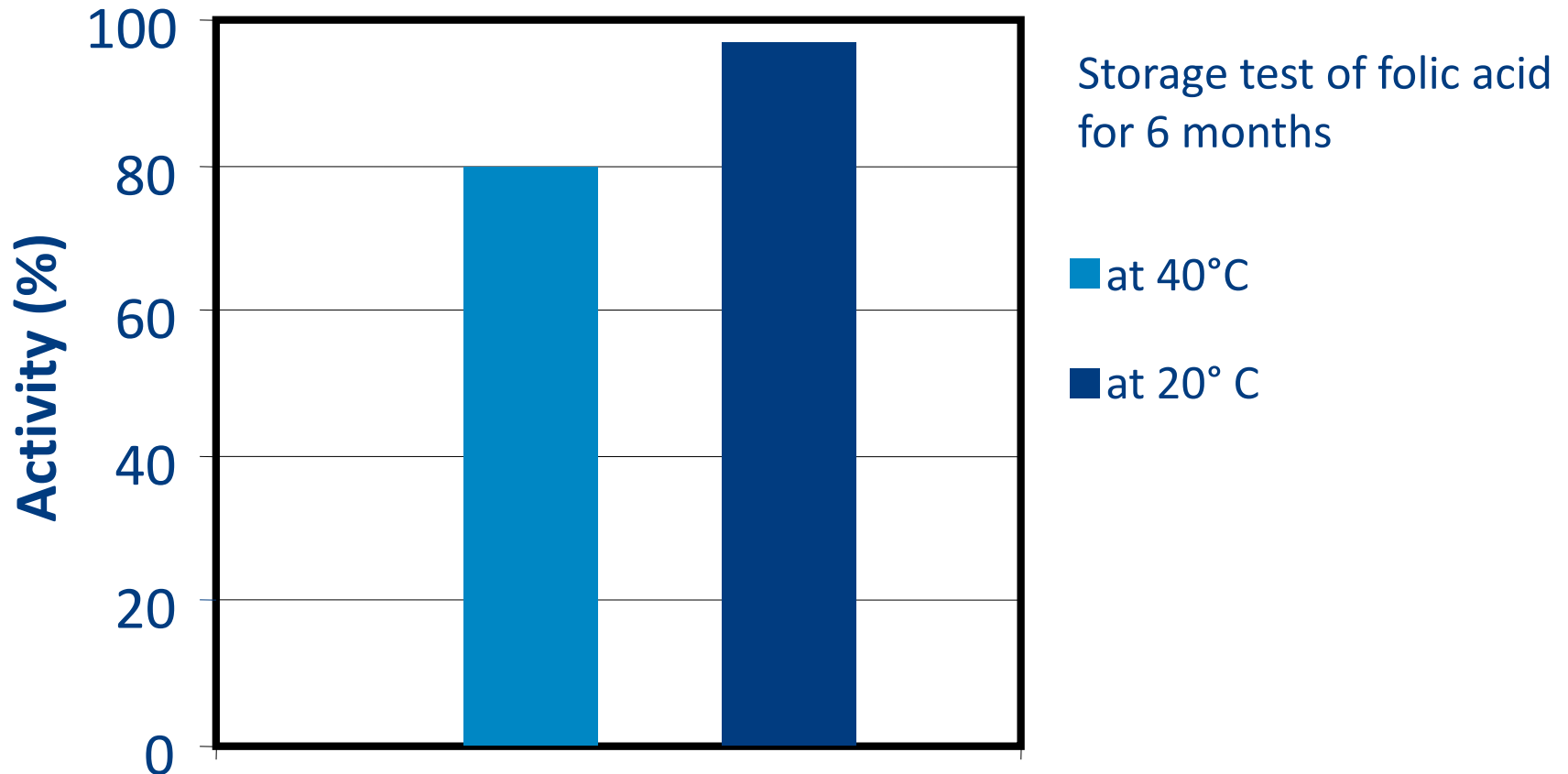
- Some vitamins lose their activity
- Some minerals interact
- Premixes are powders hence they get sticky



Micronutrient premixes need temperatures below 25°C



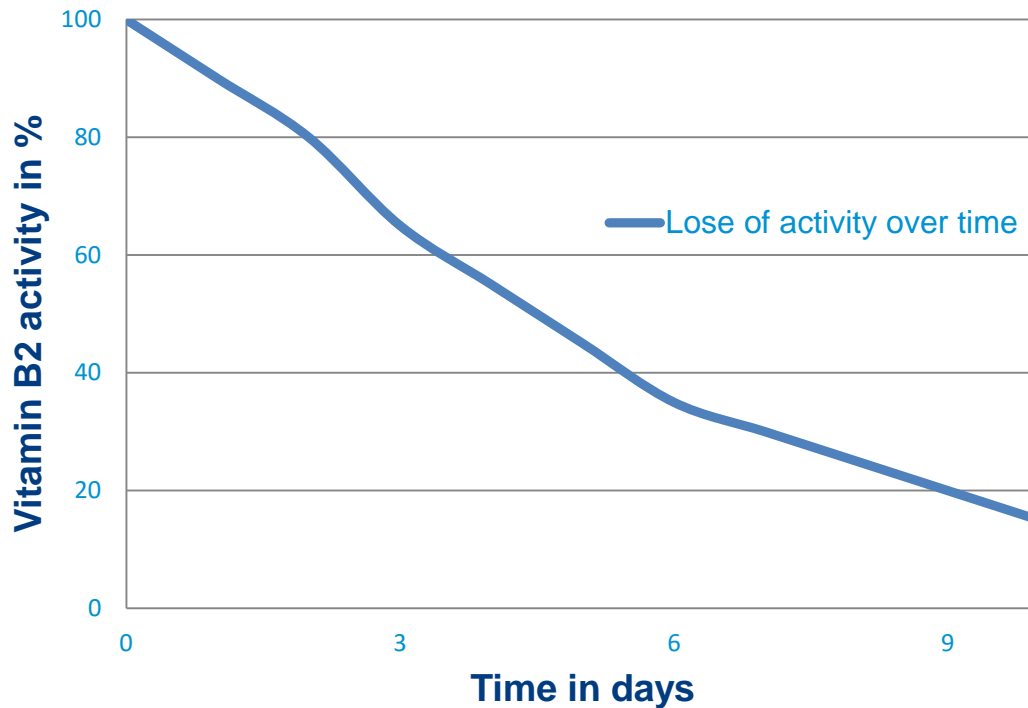
Some vitamins are sensitive to heat and lose their activity in high temperatures



Micronutrient premixes need protection from light and oxygen



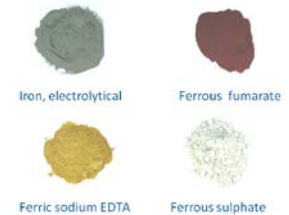
Some vitamins lose their activity in light and oxygen



Summary

1) 4 main iron sources for flour fortification

- NaFeEDTA has the highest bioavailability



2) Do not mix ascorbic acid with fortication premix

- Due to interactions at tropical conditions



3) Coarse ferrous sulphate can lead to spots on bread crust

- Keep premix closed, dry, cool & dark to avoid interactions and loss of activity





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