

Article

Migration testing of GPPS and HIPS polymers: swelling effect caused by food simulants compared to real foods

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Supplementary material -2 (Visual changes)

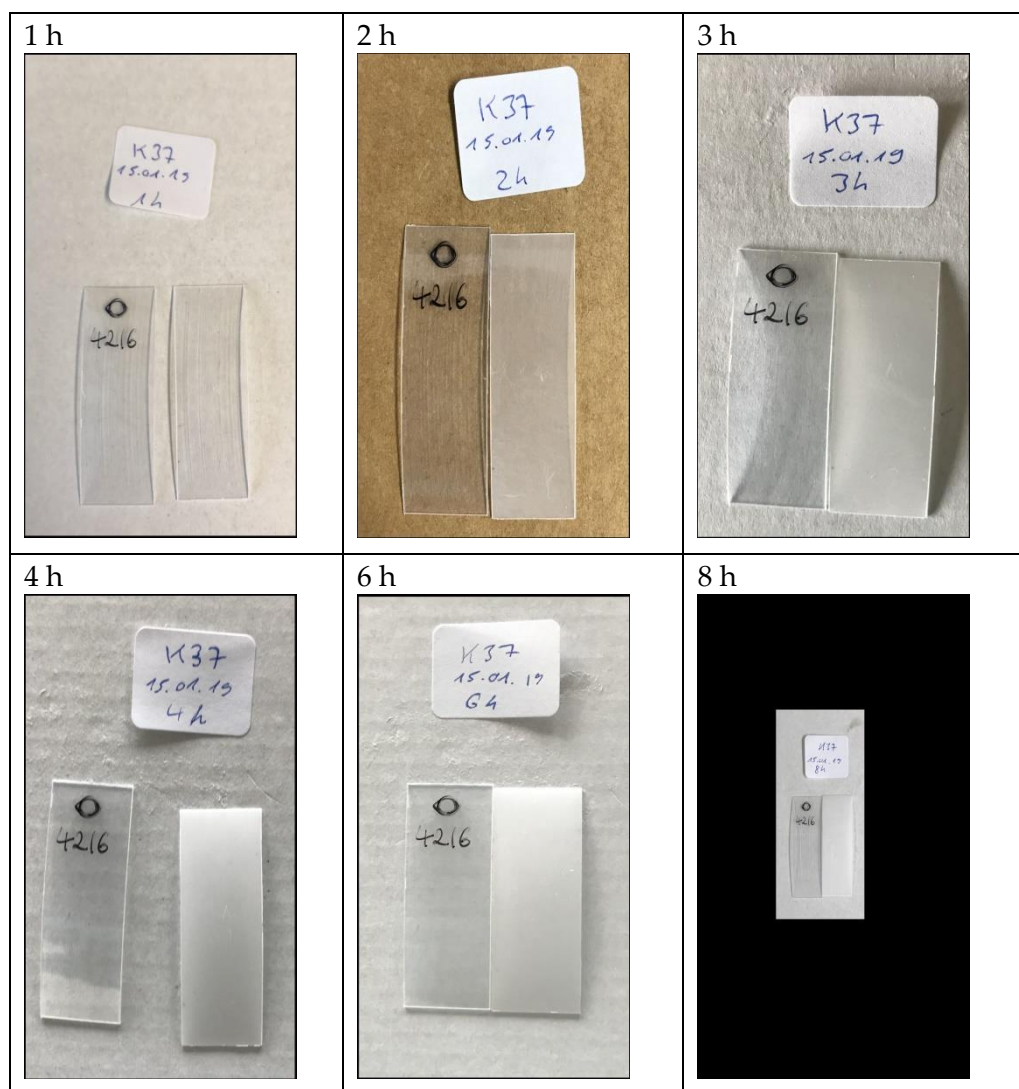
In addition to the analytical determination of the weight increase and of the migration kinetics from GPPS and HIPS polymers after contact with different food and food simulants at several time-temperature testing conditions, at most kinetic time points photos were taken to document visual changes of the sample material.

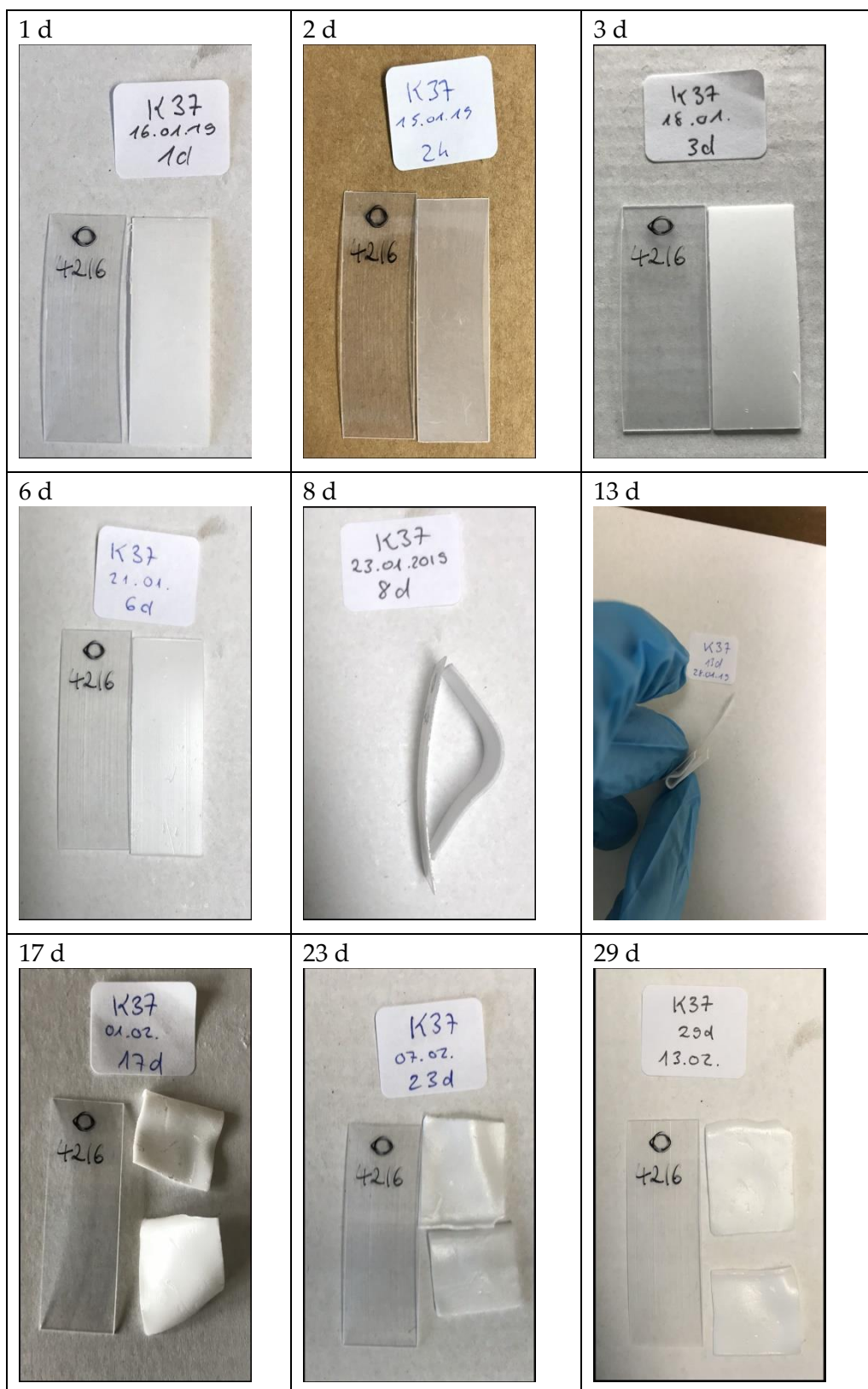
For a better comparison, an original GPPS or HIPS strip (marked with a black ring) was put next to the test strip in all photos.

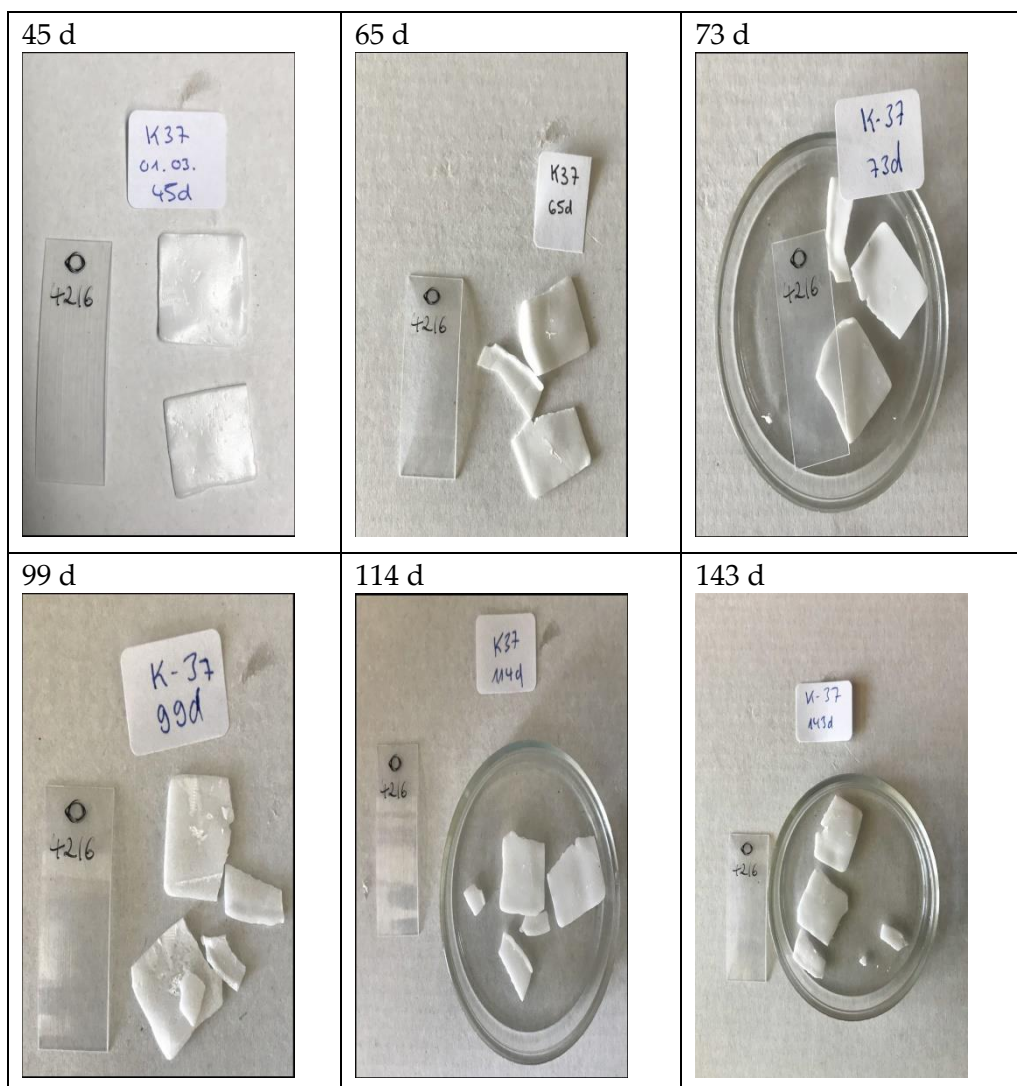
GPPS (general purpose polystyrene)

1 Contact with Isooctane

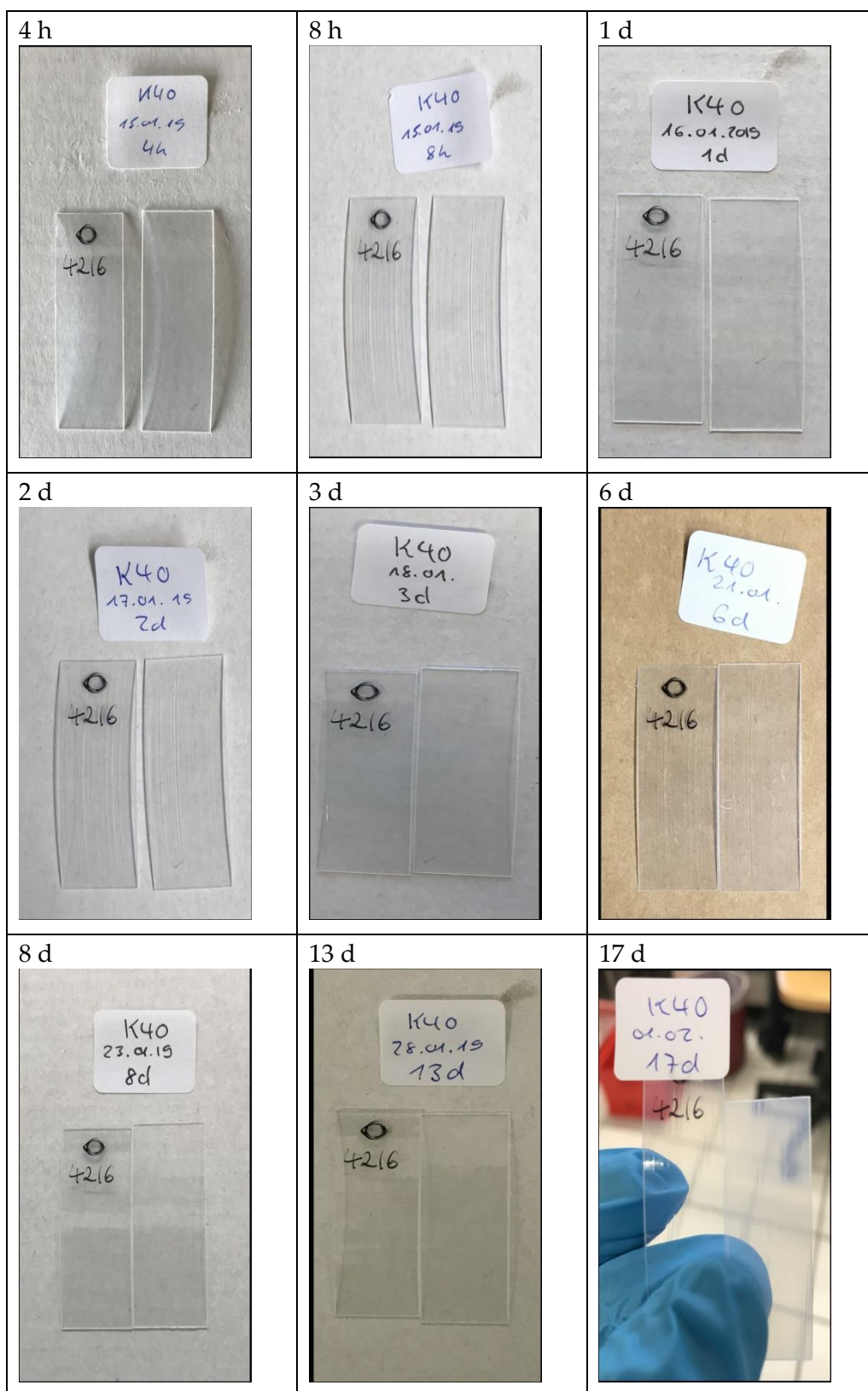
1.1 Isooctane at 60 °C

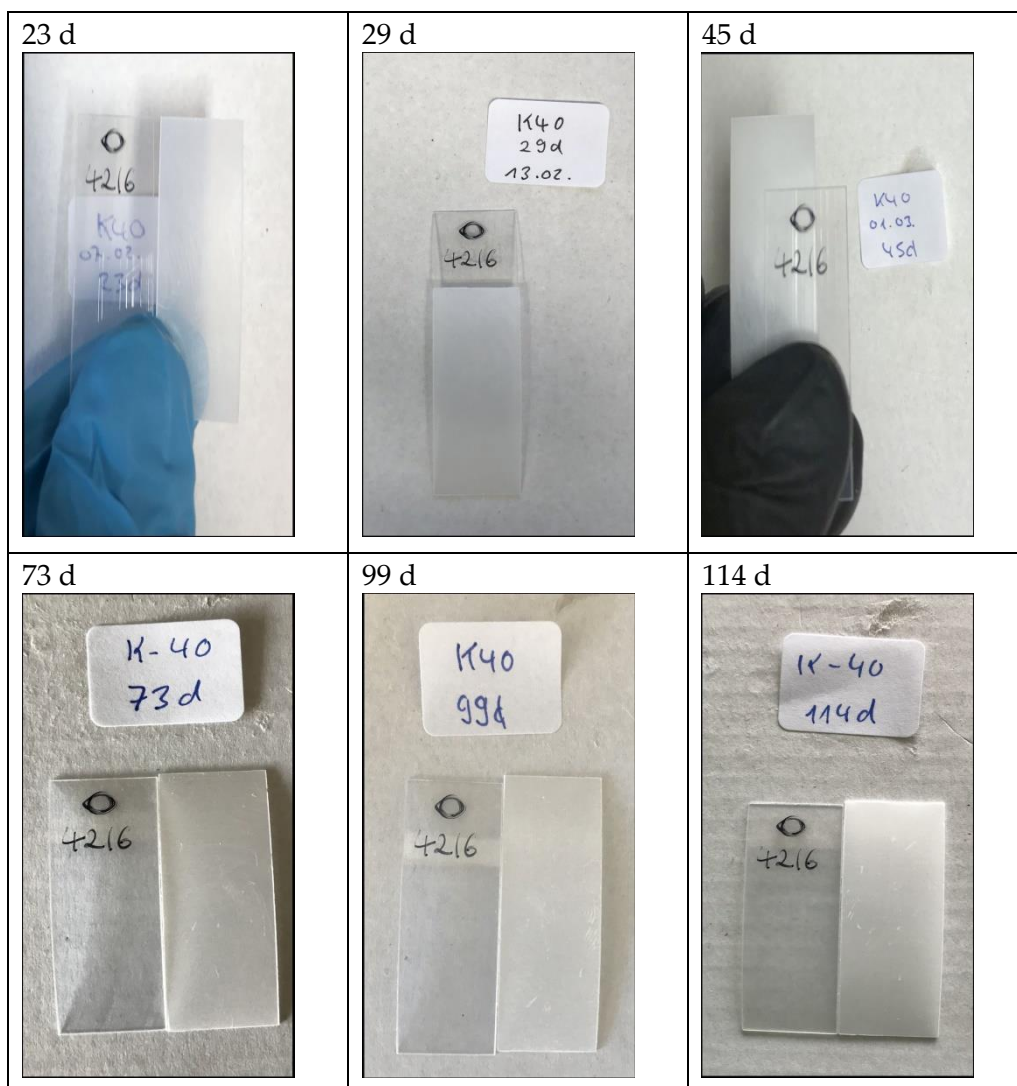




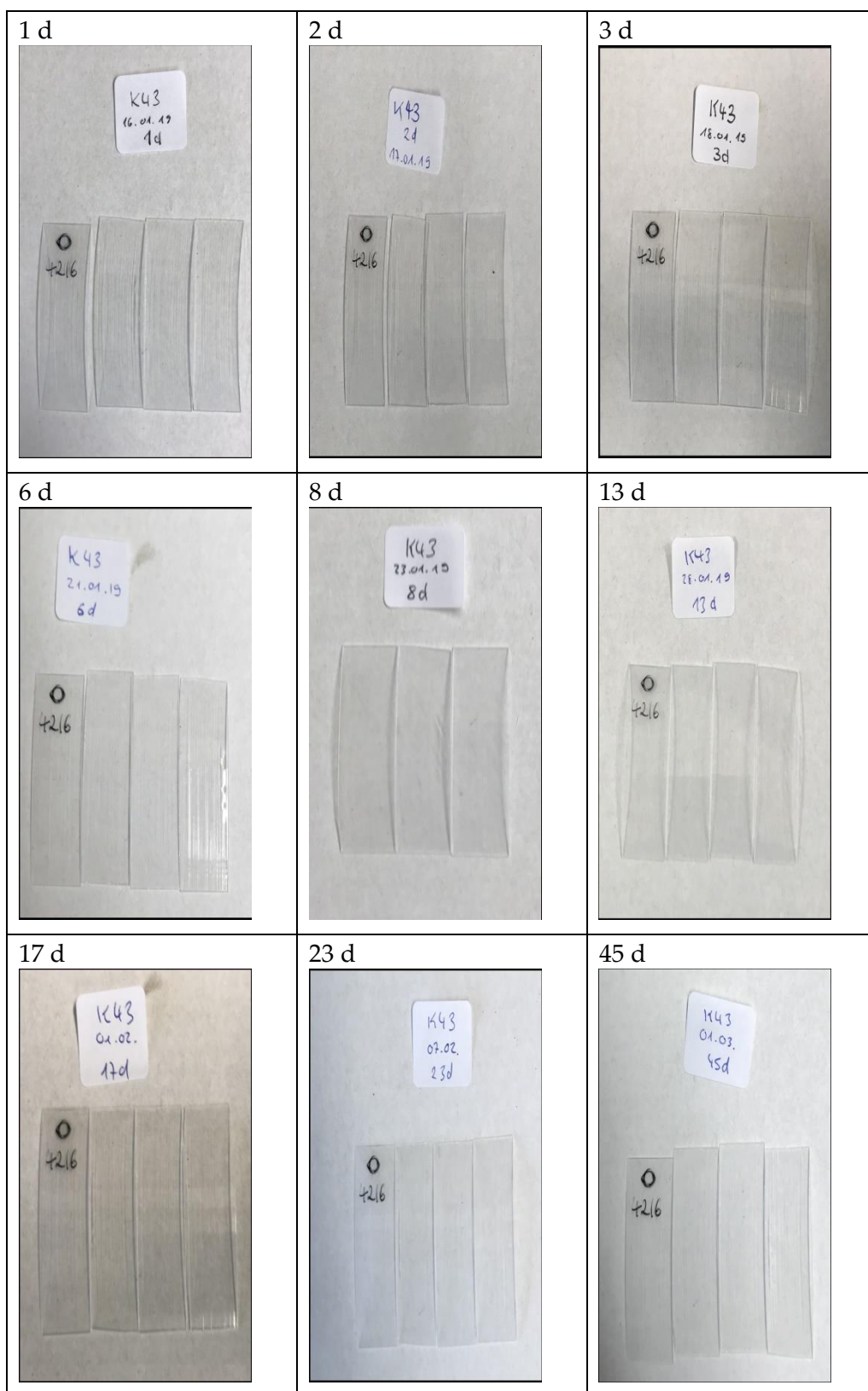


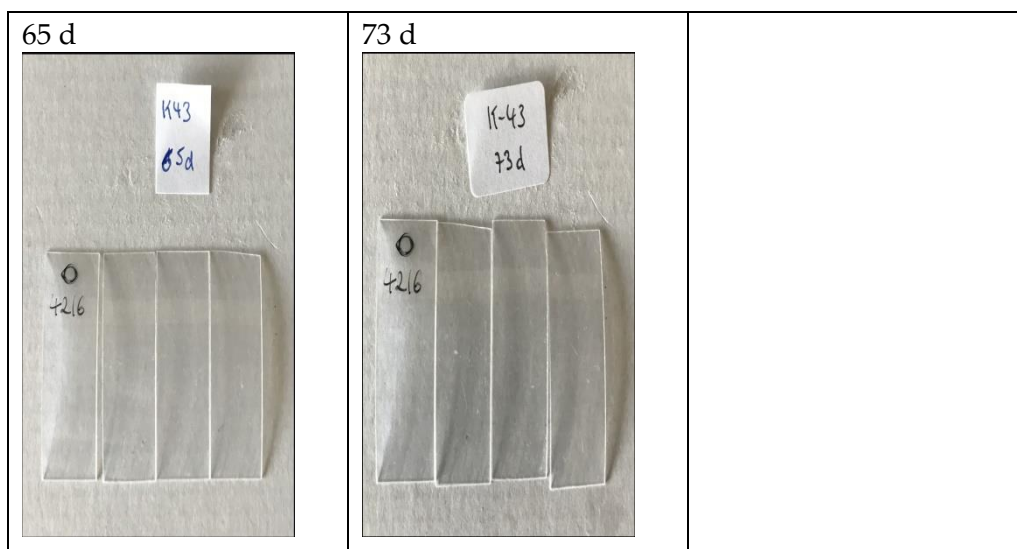
1.2 Isooctane at 40 °C





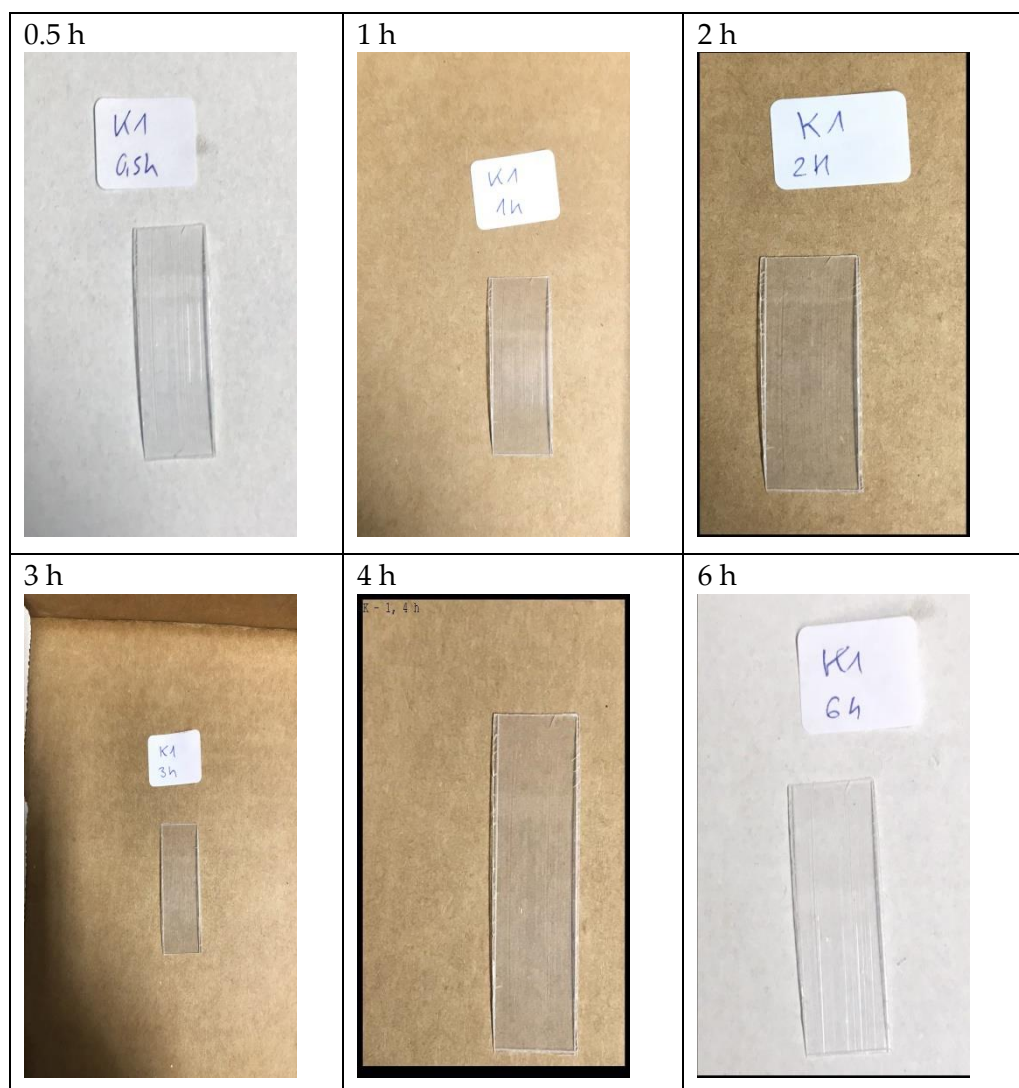
1.3 Isooctane at 20 °C

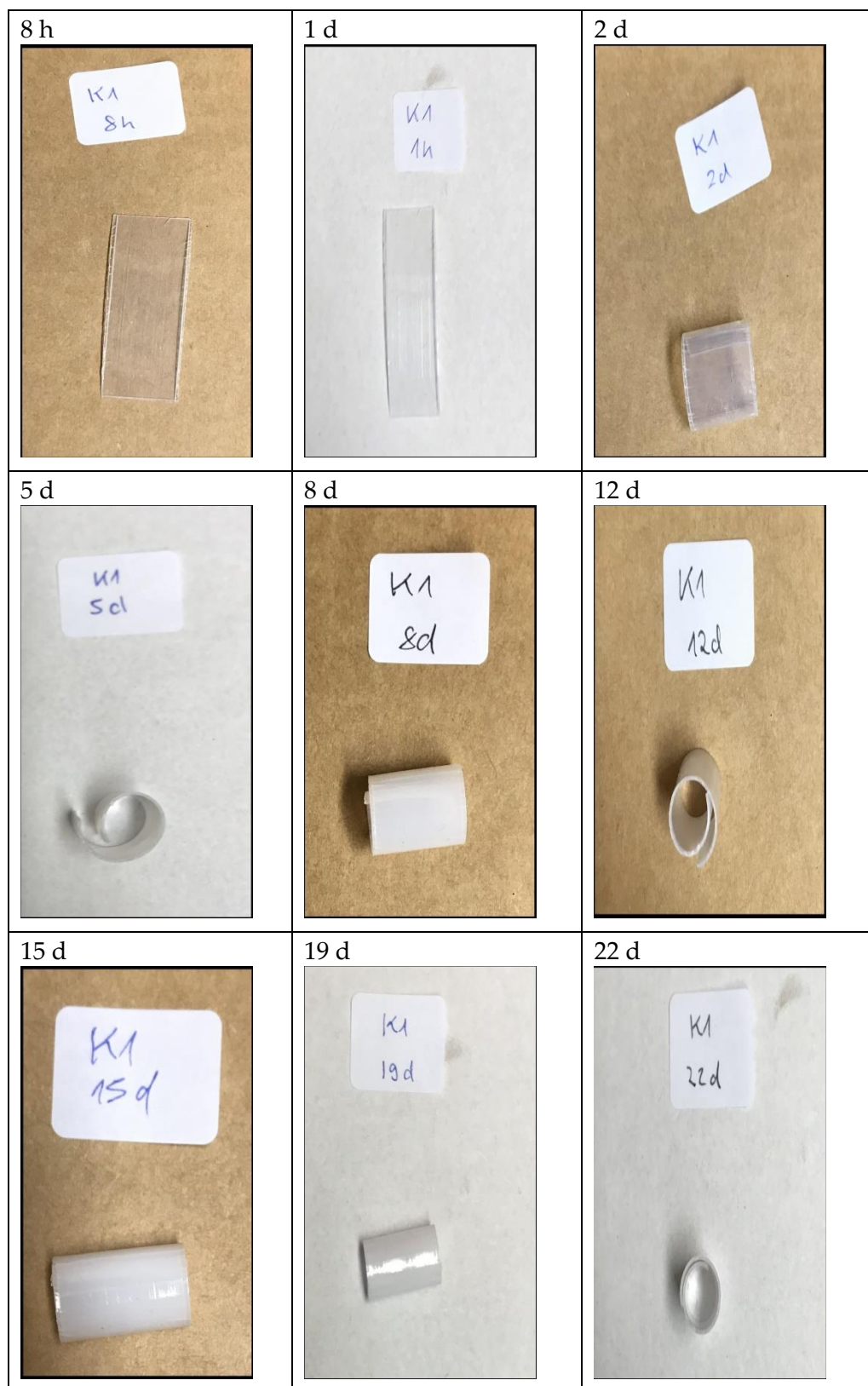


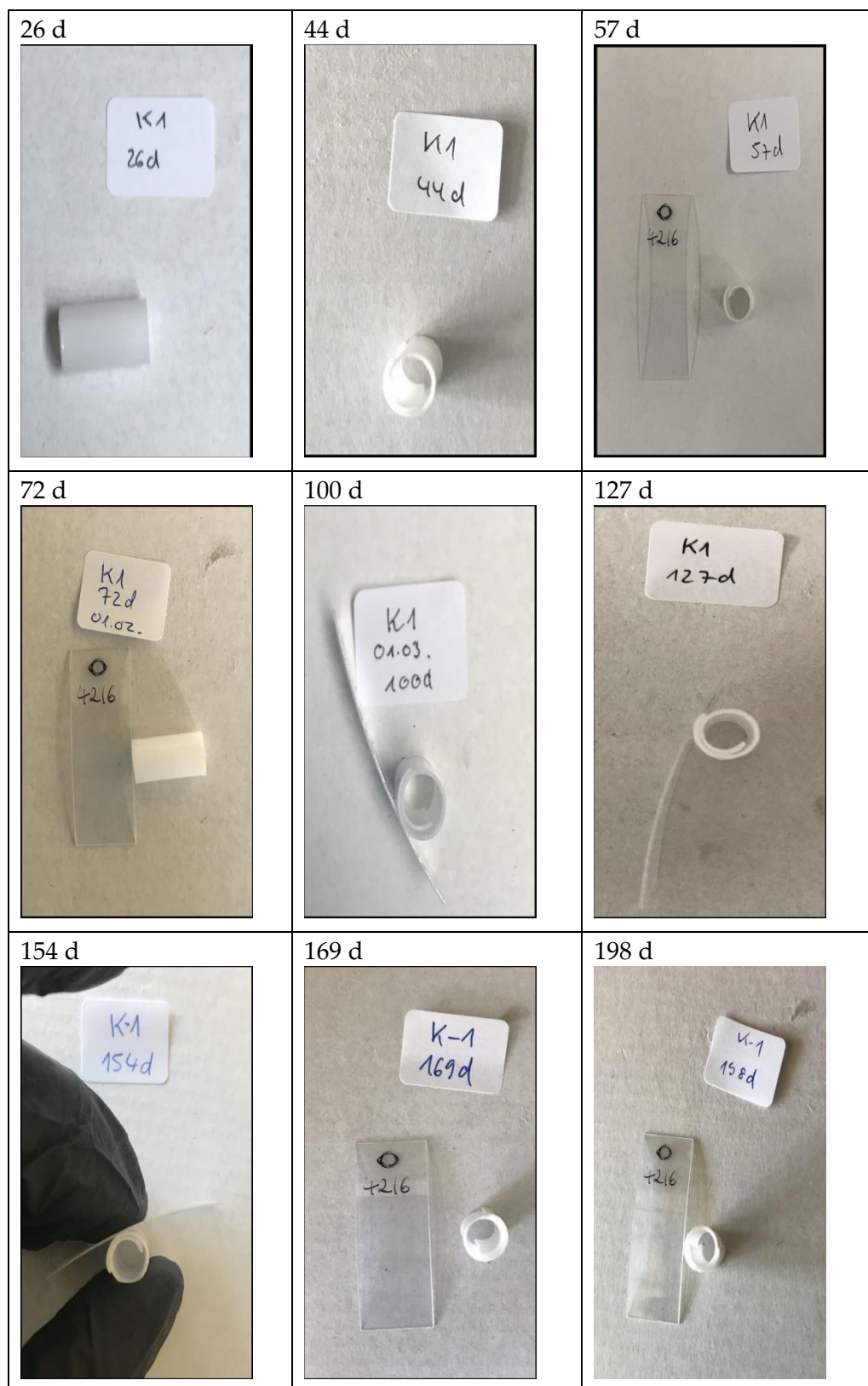


2 Contact with 95% Ethanol

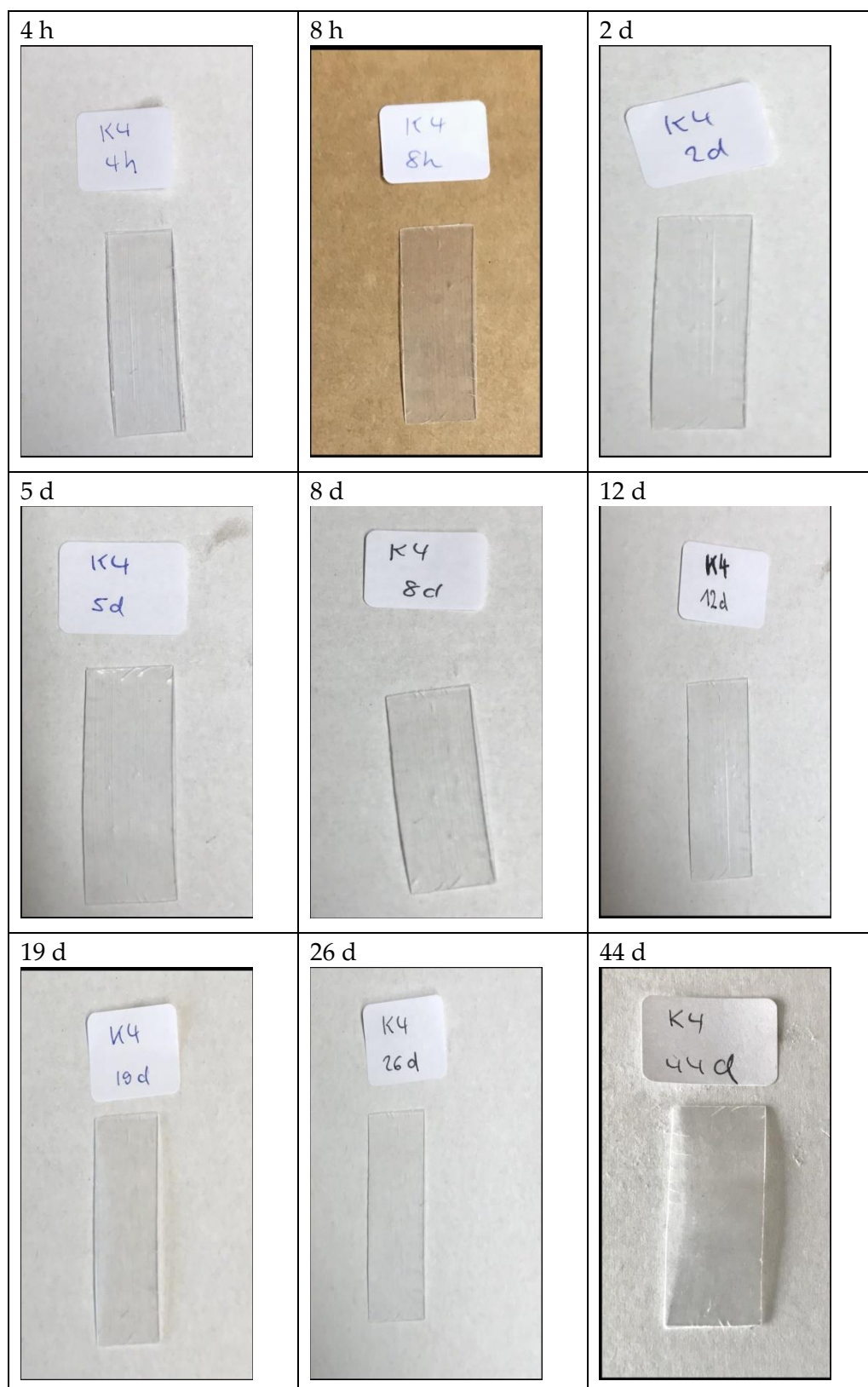
2.1 95% Ethanol at 60 °C

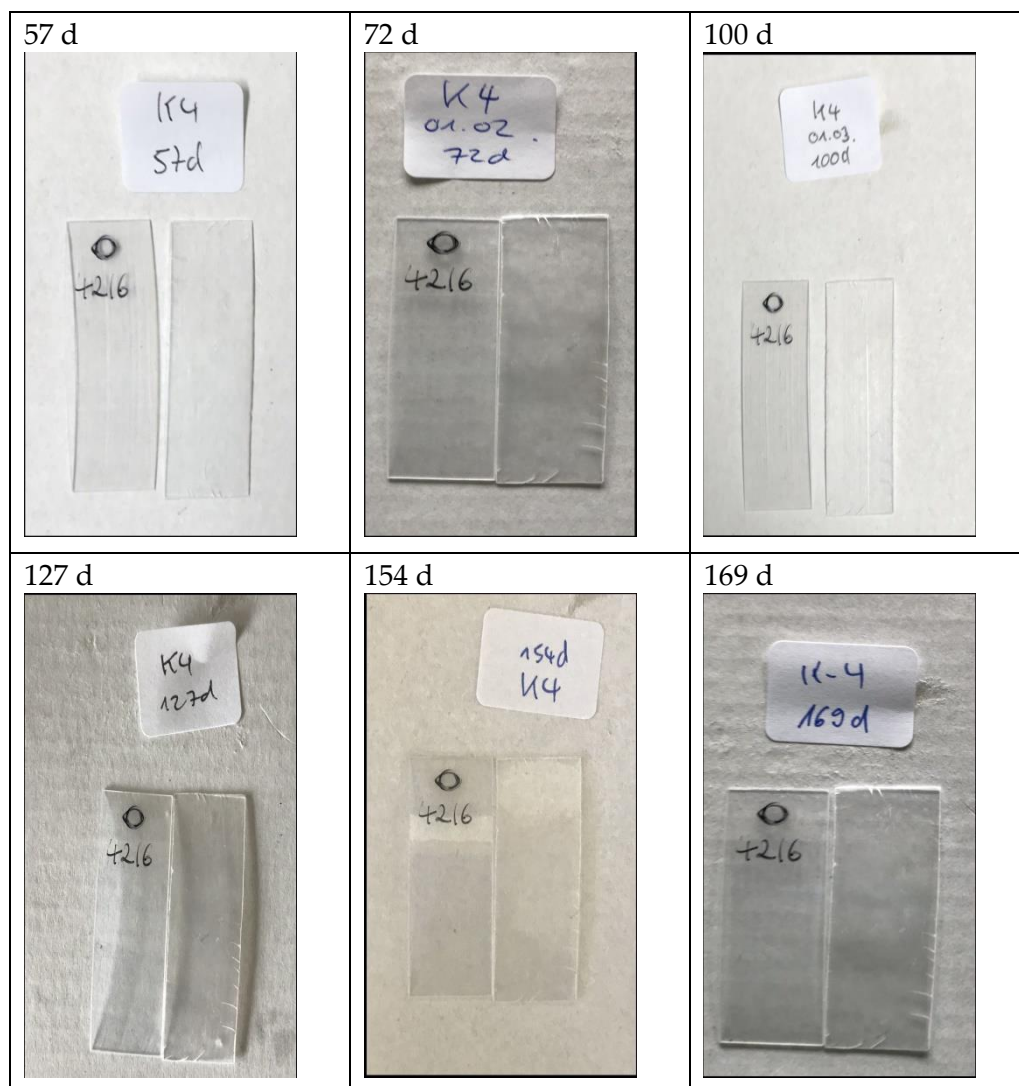






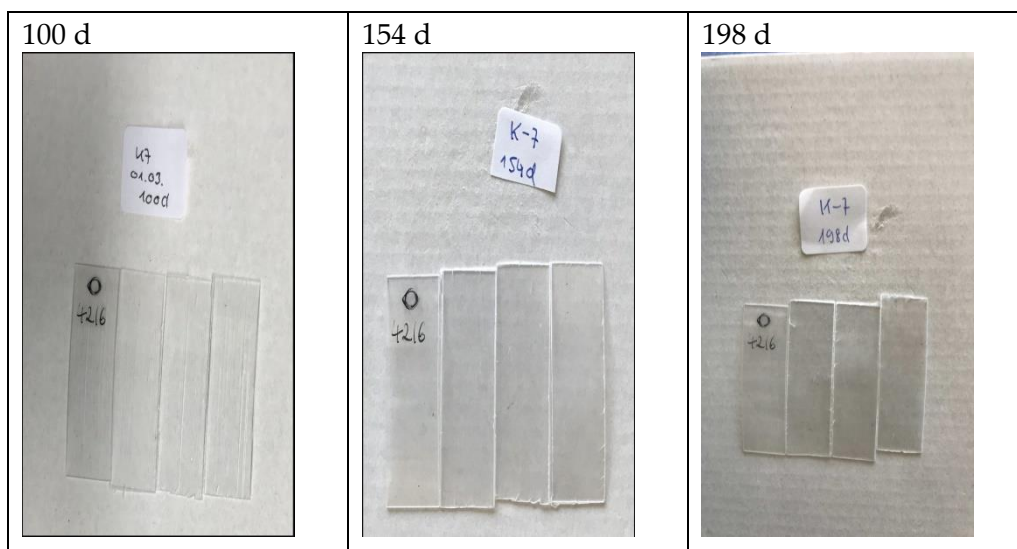
2.2 95% Ethanol at 40 °C





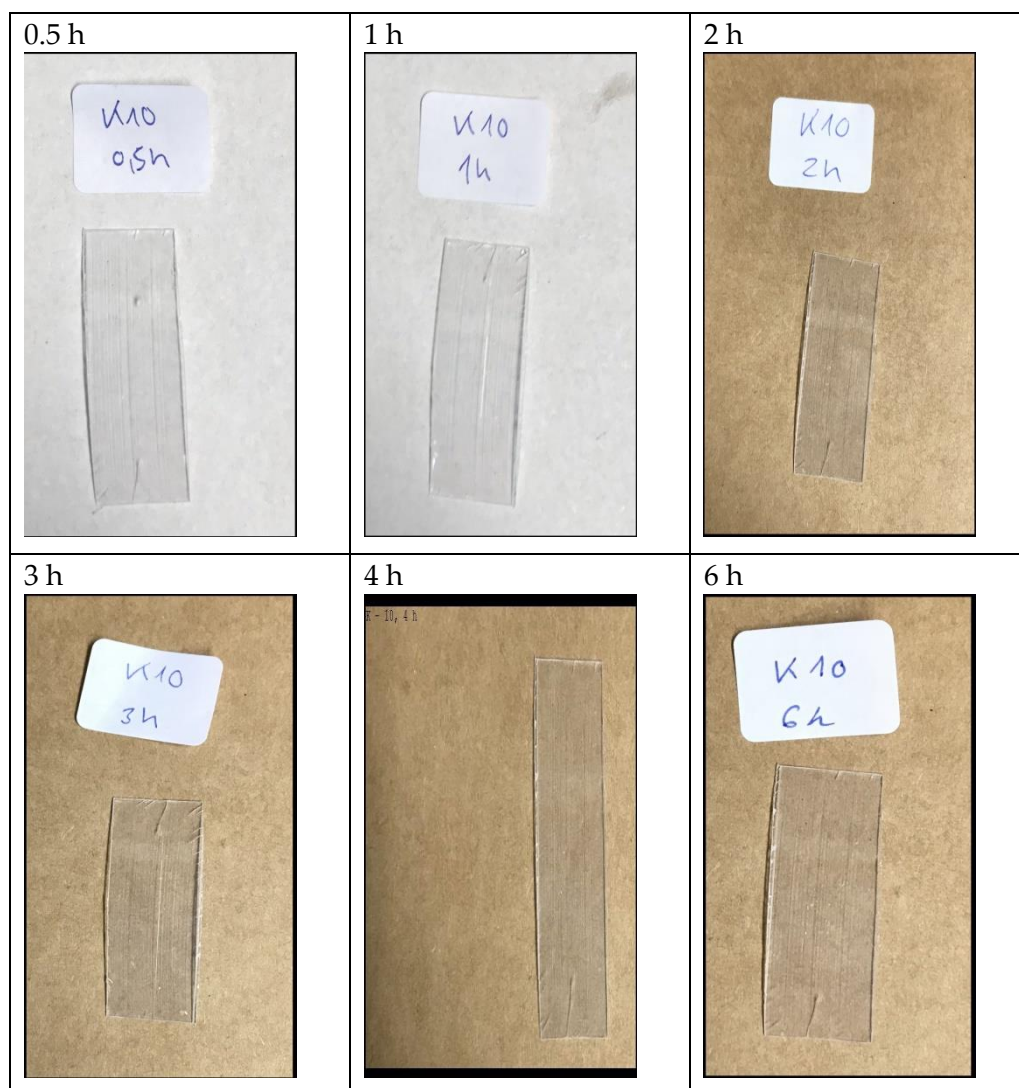
2.3 95% Ethanol at 20 °C

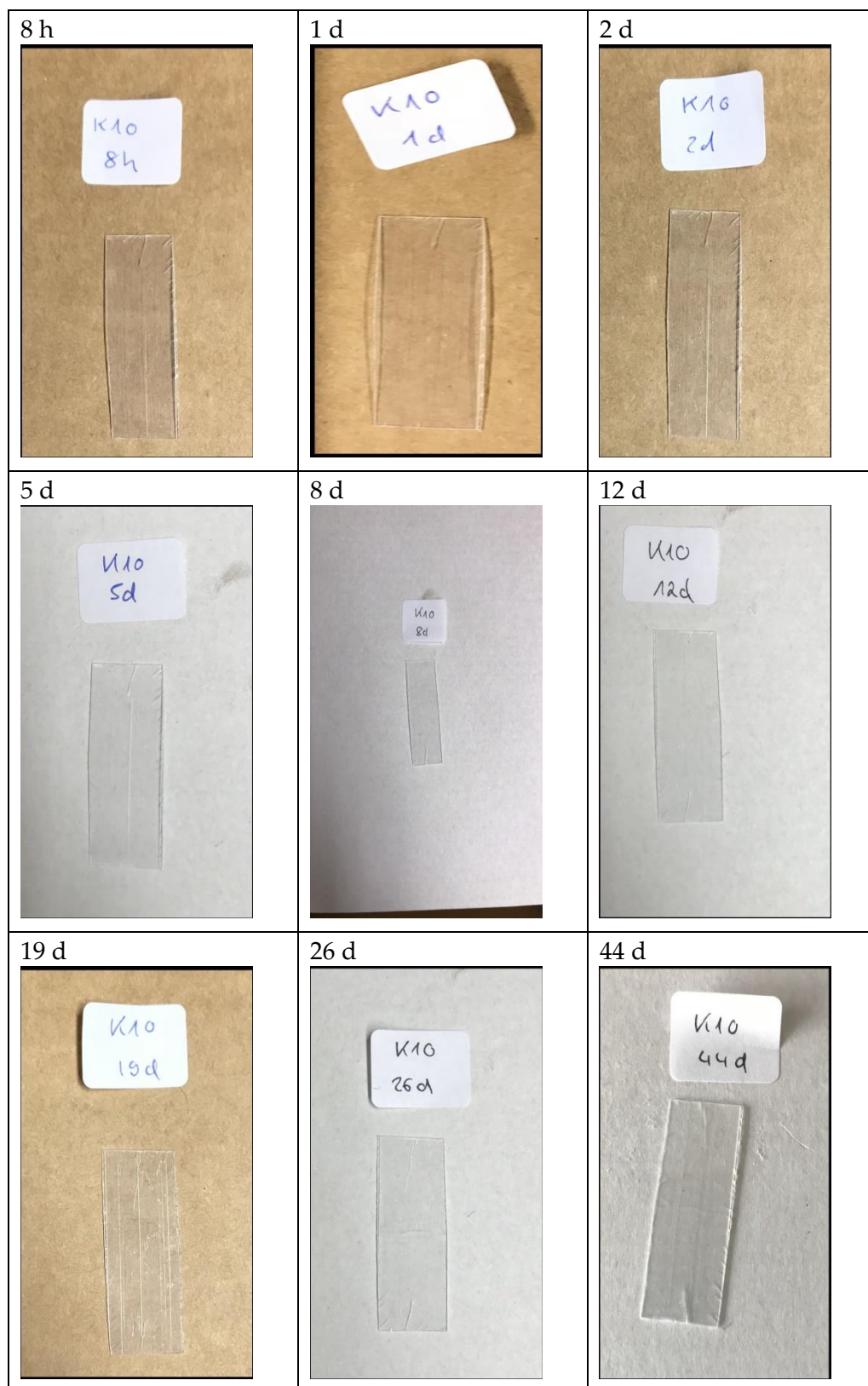


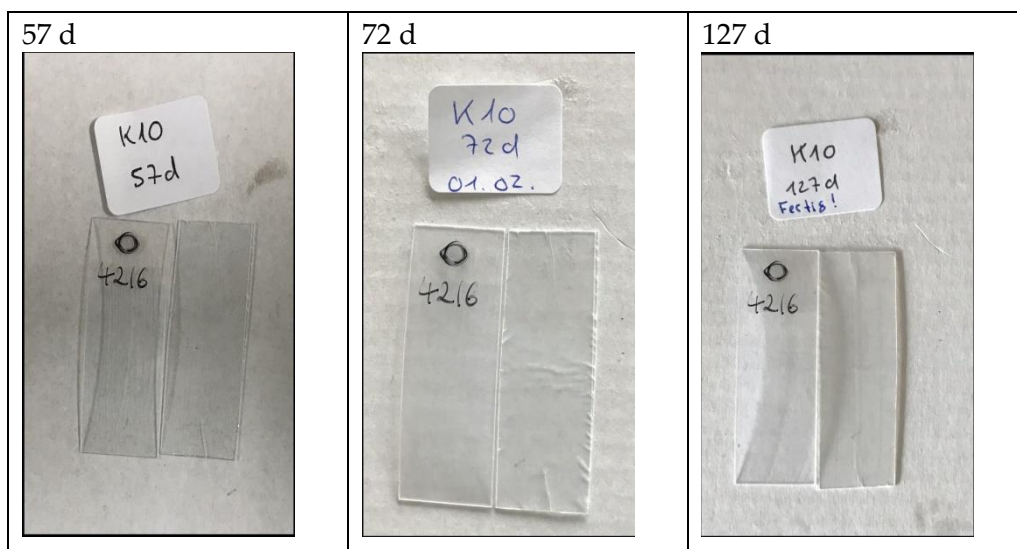


3 Contact with 50% Ethanol

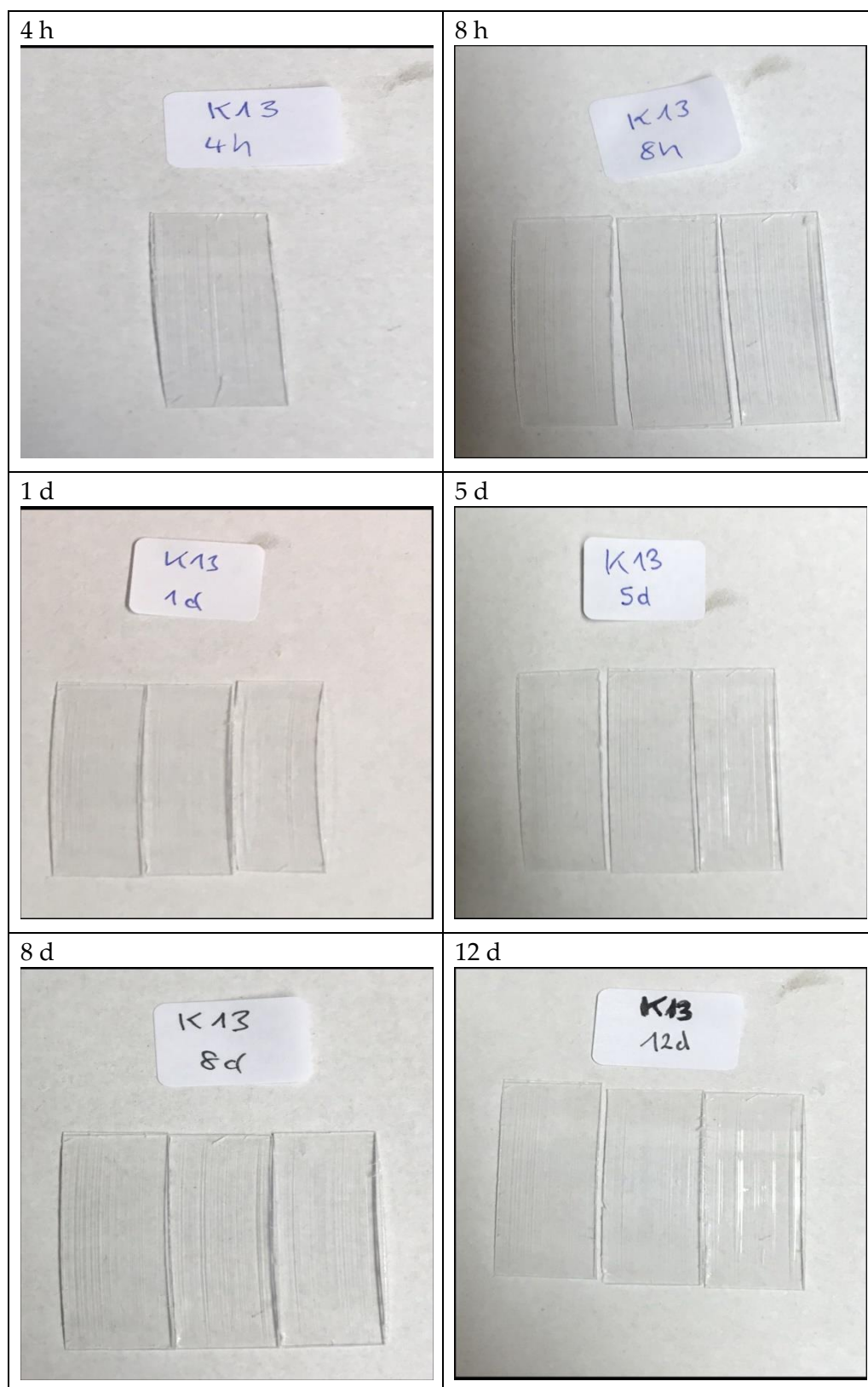
3.1 50% Ethanol at 60 °C

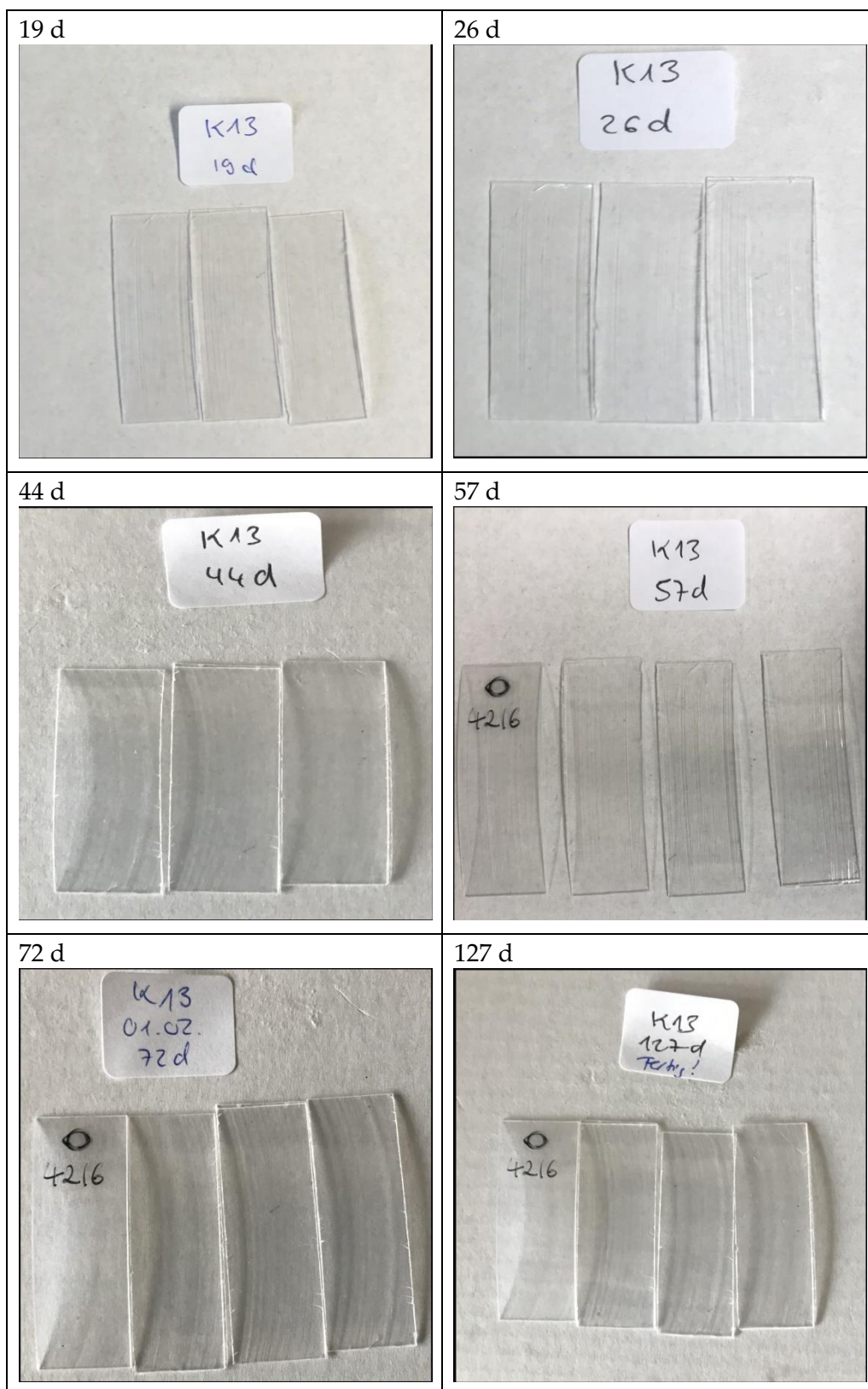




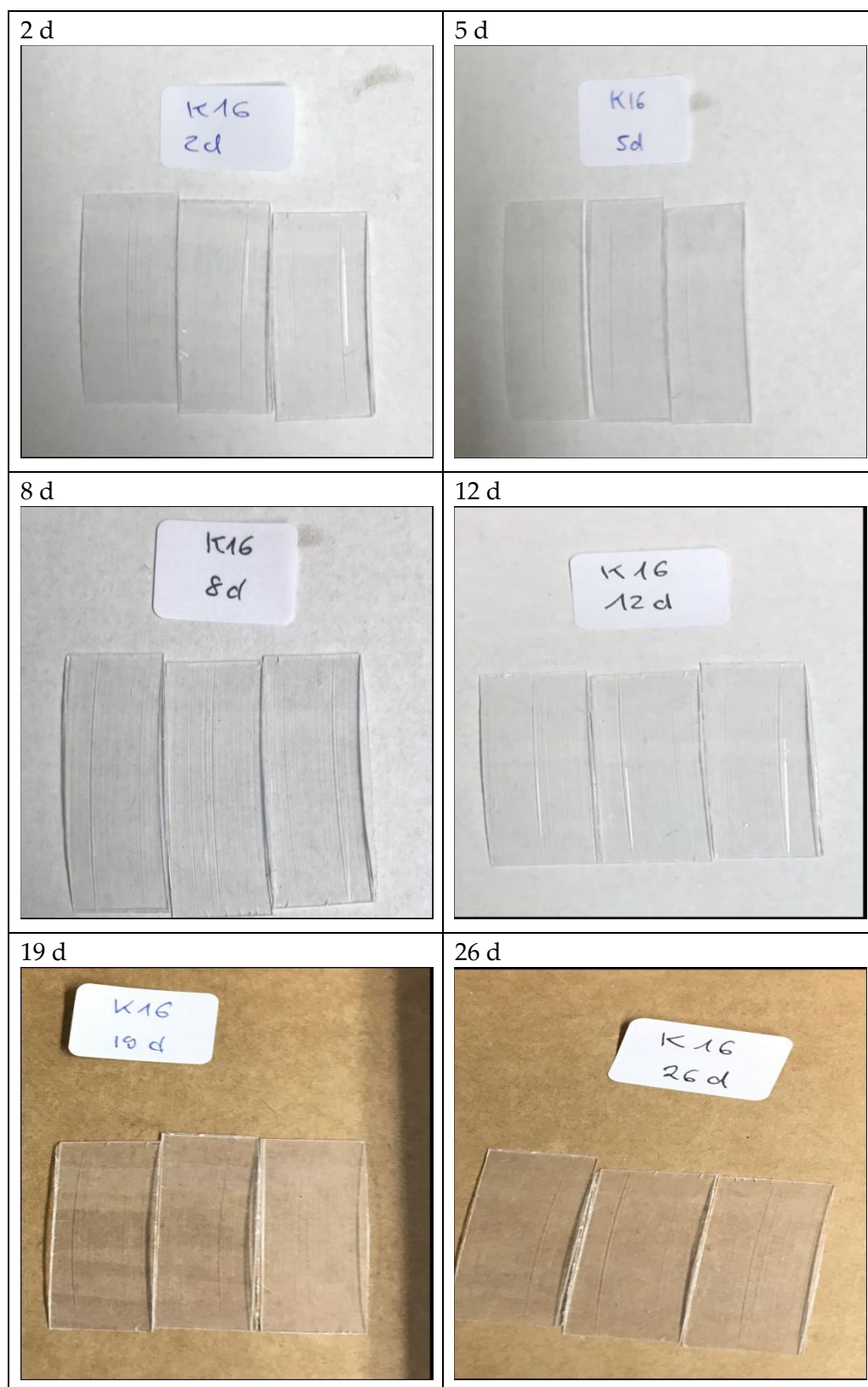


3.2 50% Ethanol at 40 °C





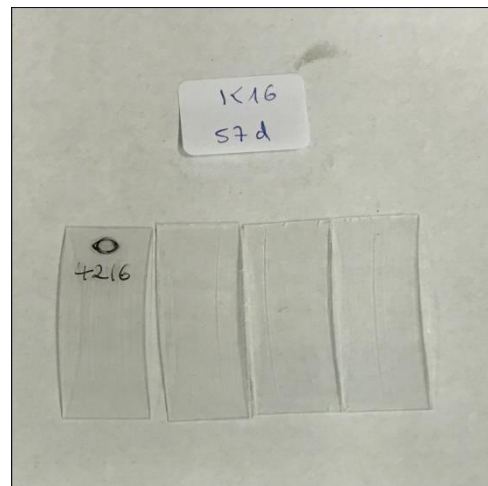
3.3 50% Ethanol at 20 °C



44 d



57 d



72 d

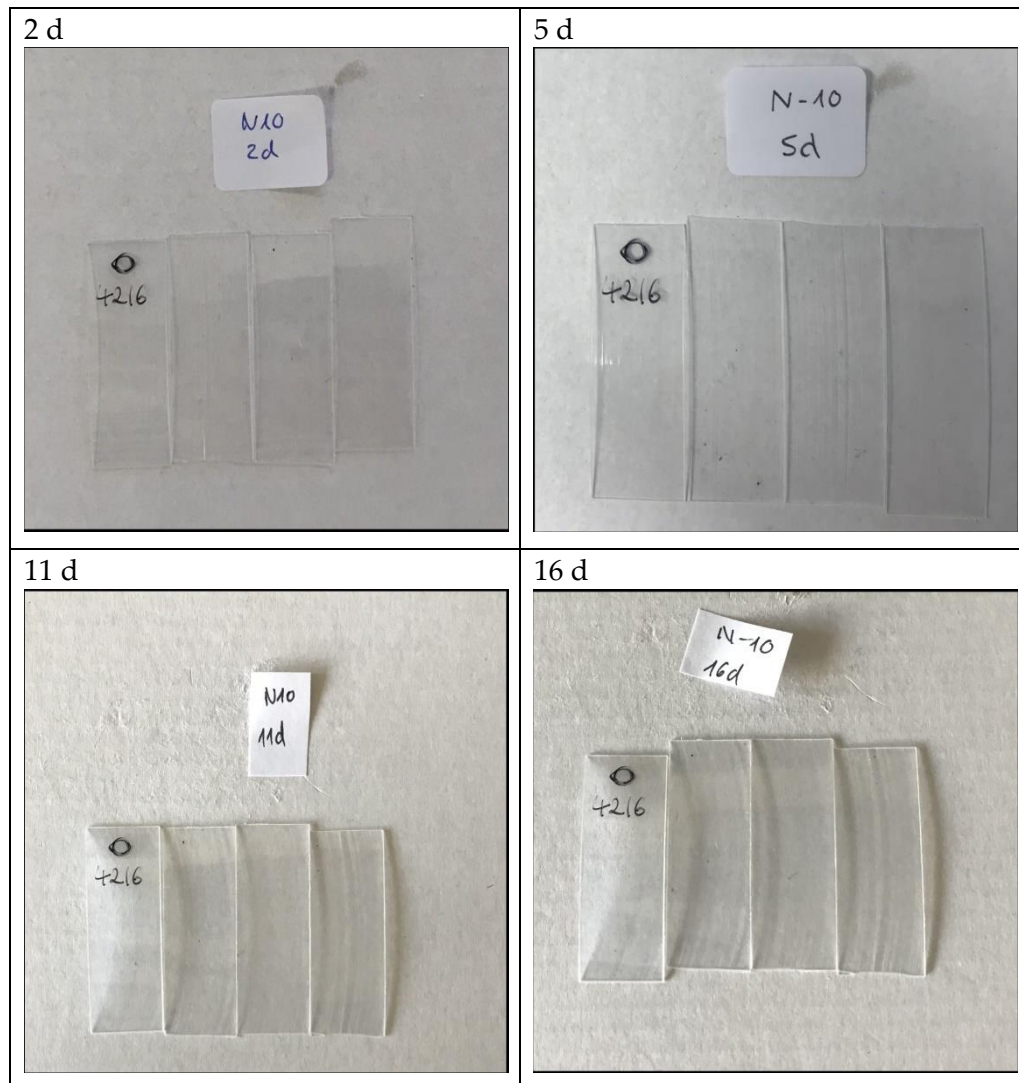


127 d



4 Contact with 20% Ethanol

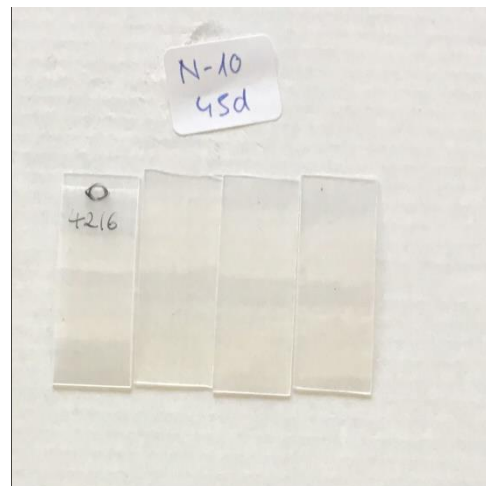
4.1 20% Ethanol at 60 °C



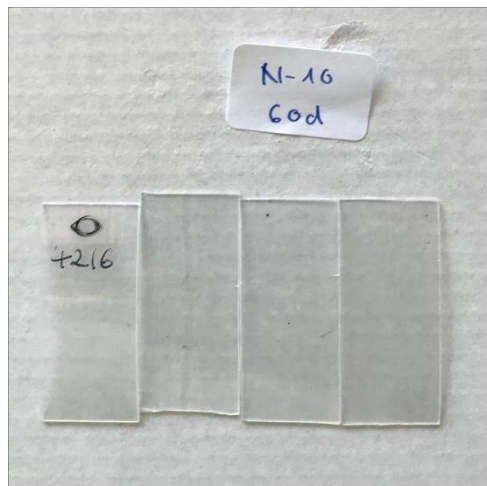
19 d



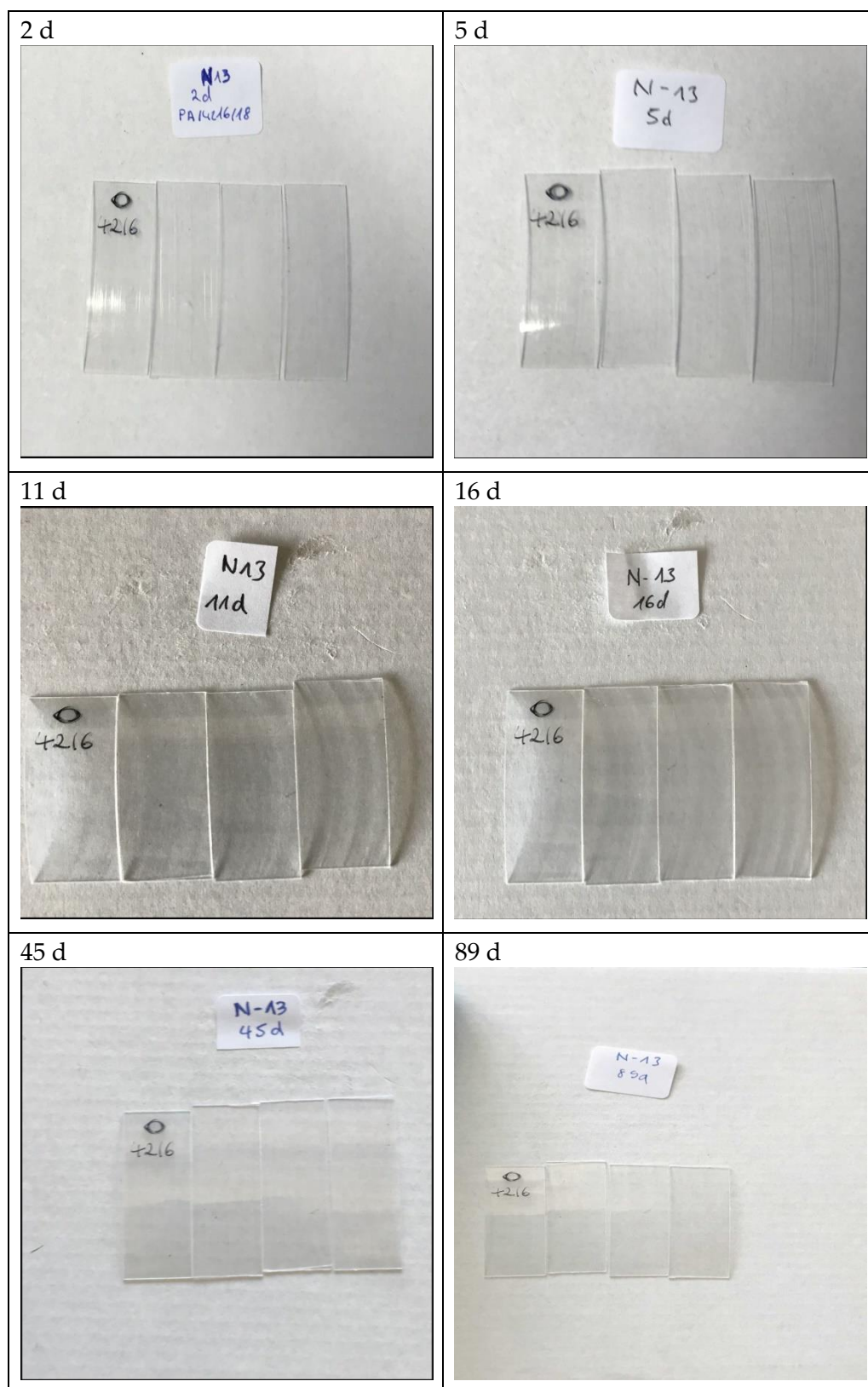
45 d



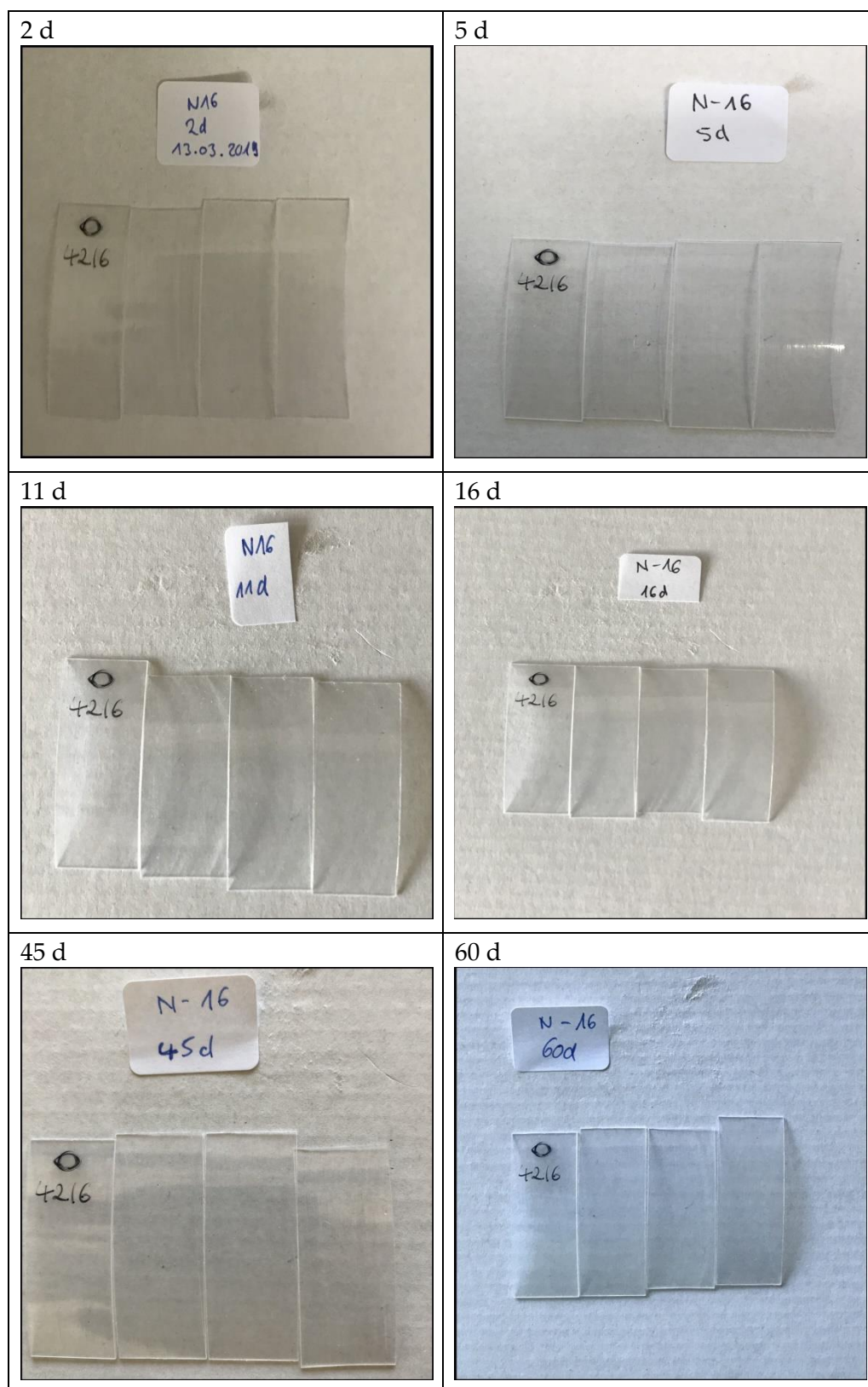
60 d



4.2 20% Ethanol at 40 °C



4.3 20% Ethanol at 20 °C

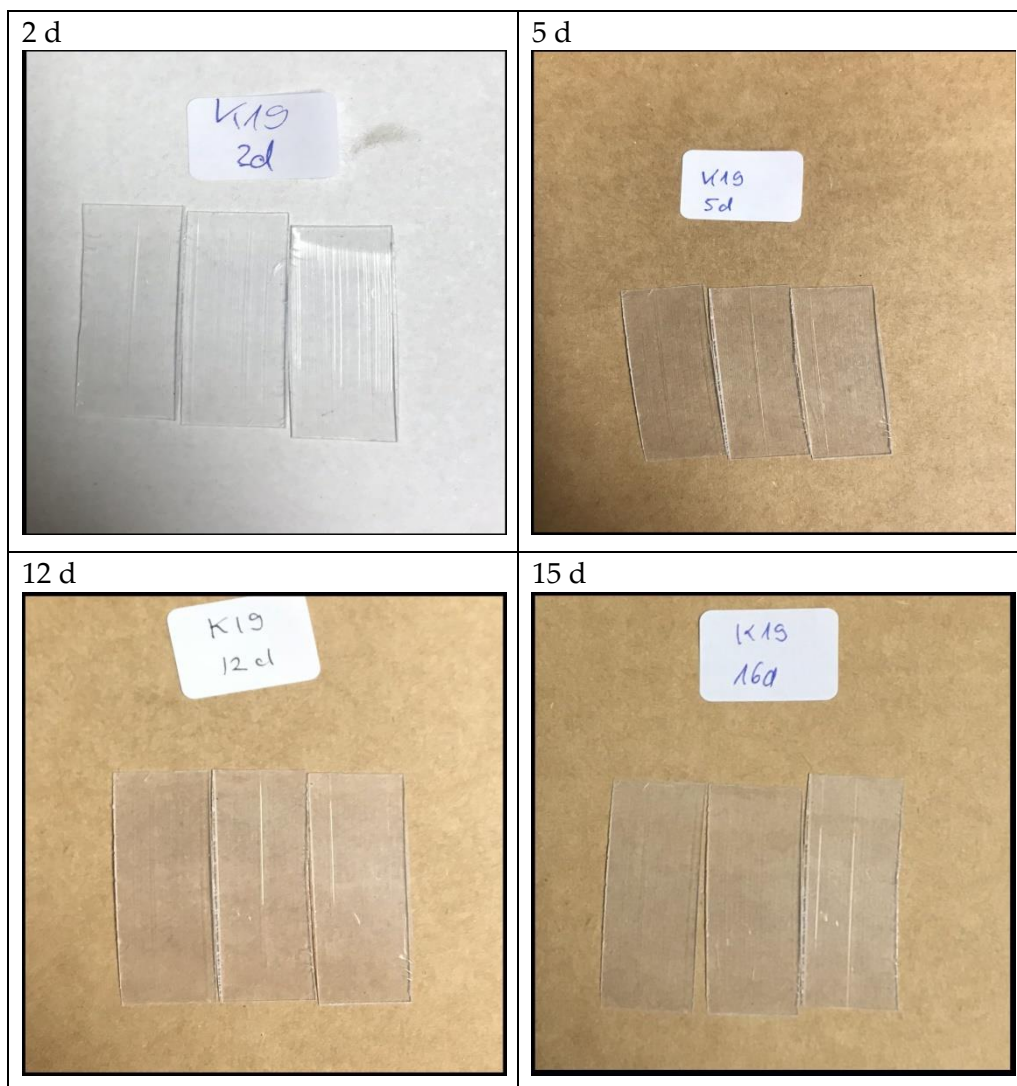


89 d



5 Contact with 10% Ethanol

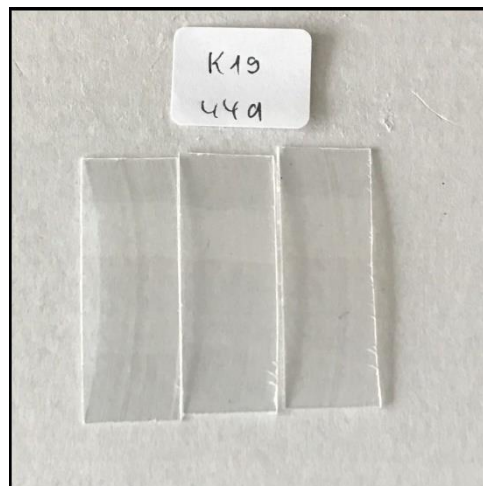
5.1 10% Ethanol at 60 °C



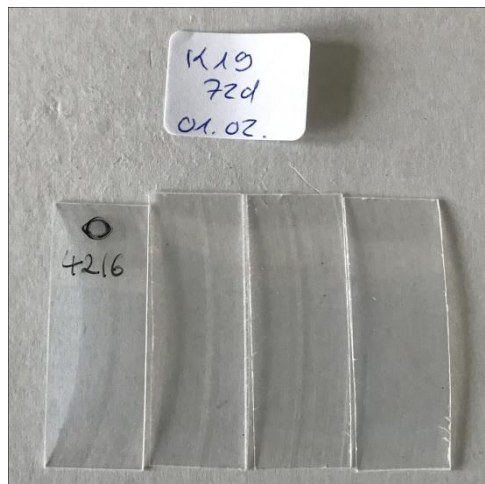
22 d



44 d



72 d



100 d

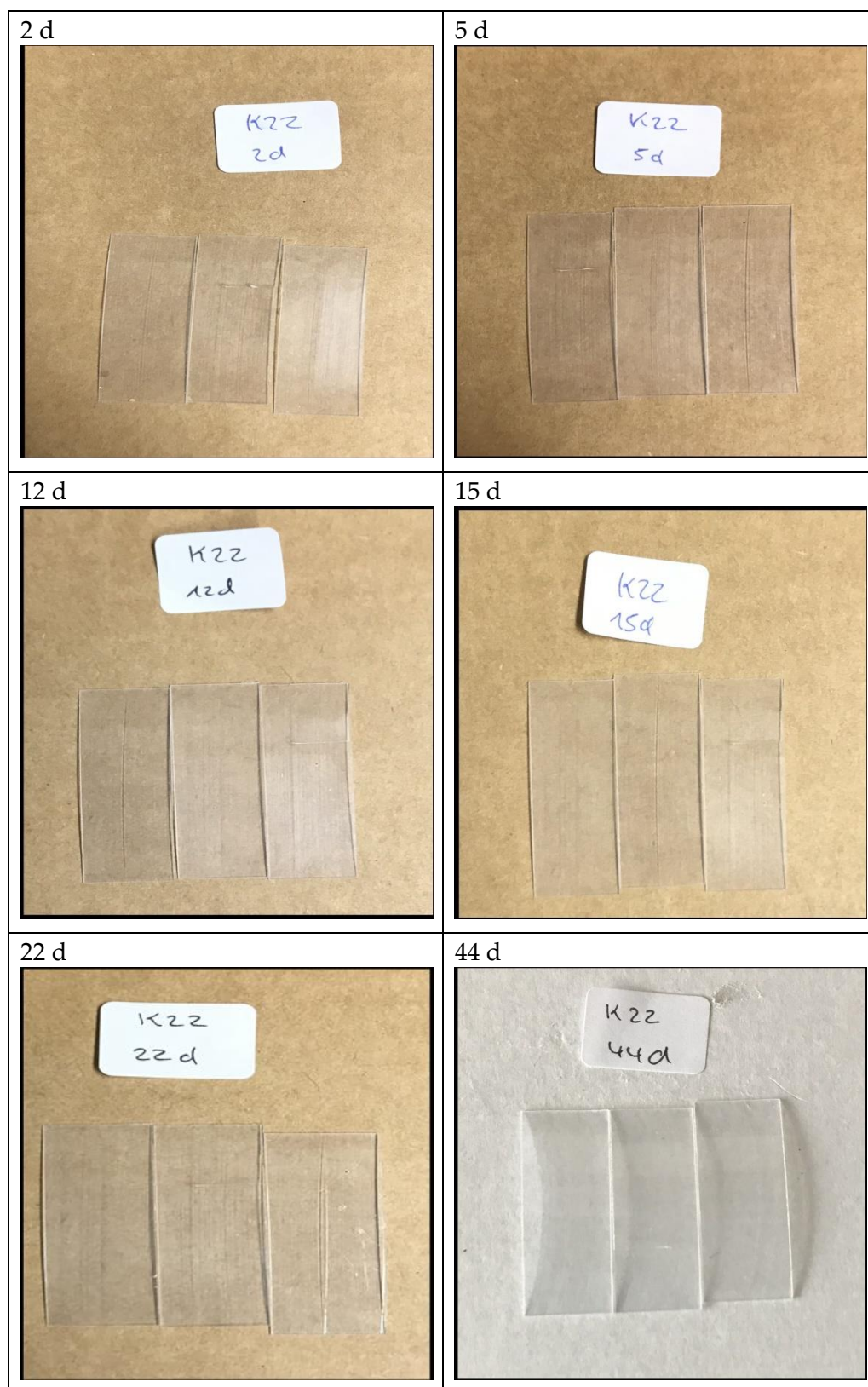


127

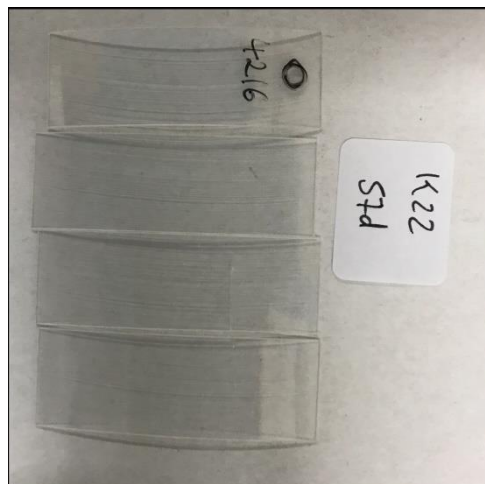


d

5.2 10% Ethanol at 40 °C



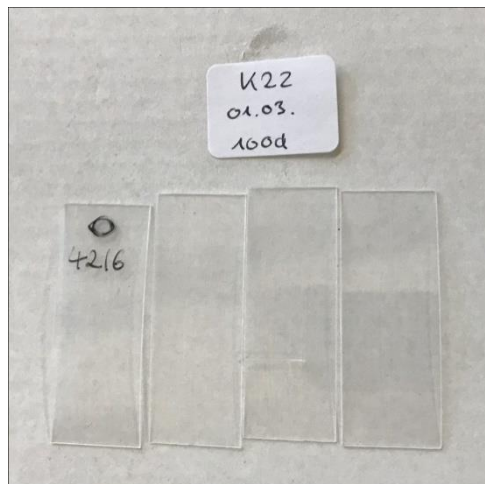
57 d



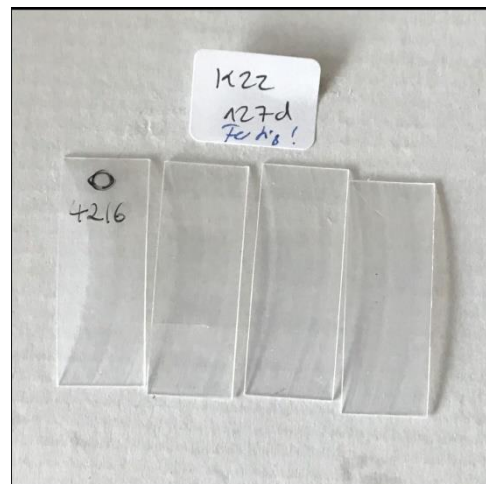
72 d



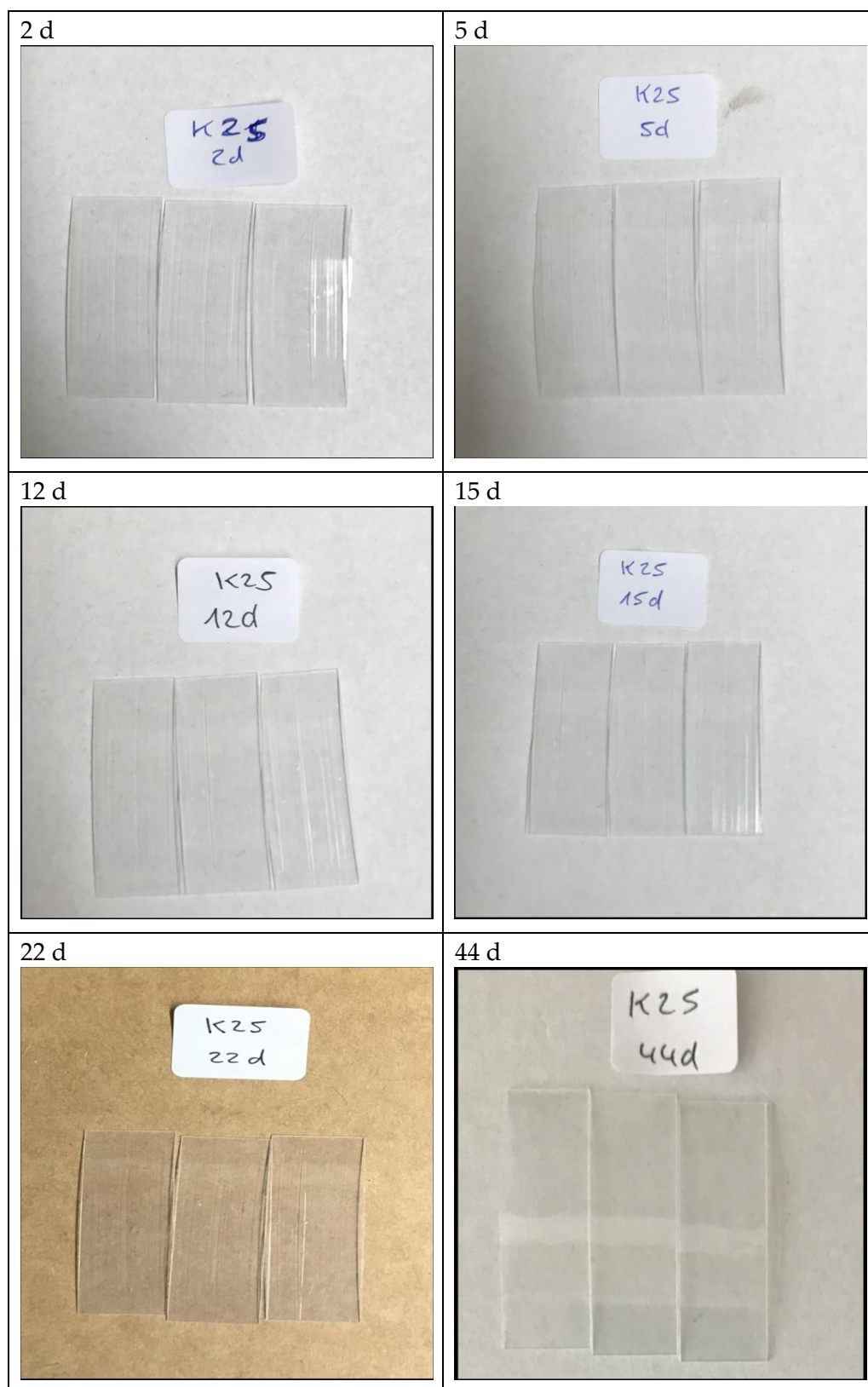
100 d



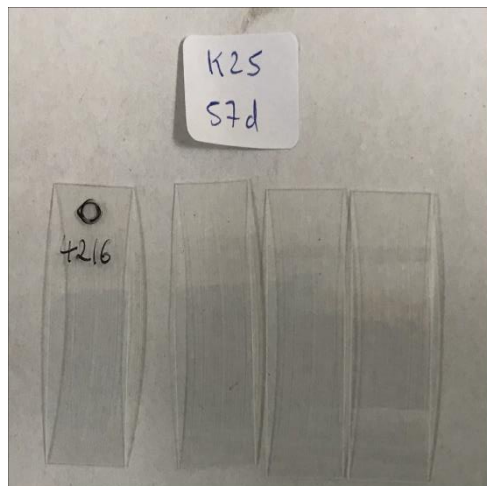
127 d



5.3 10% Ethanol at 20 °C



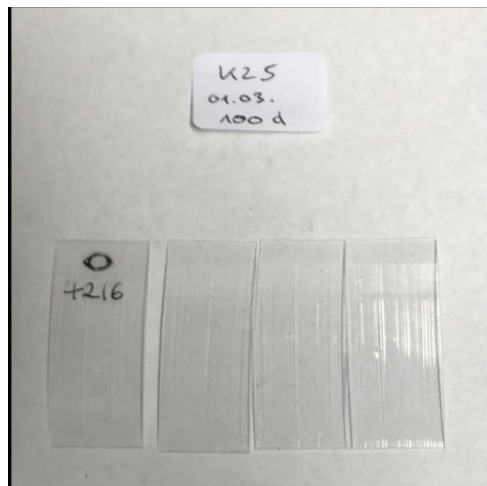
57 d



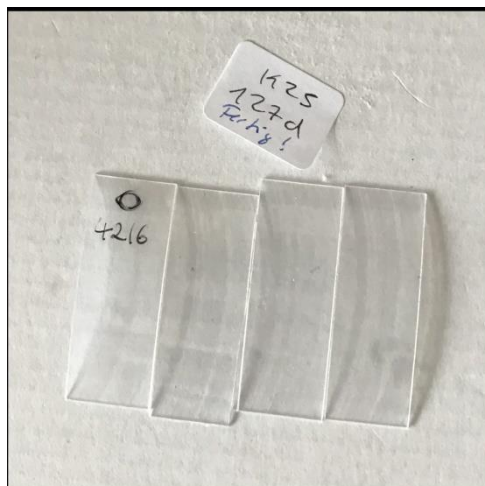
72 d



100 d

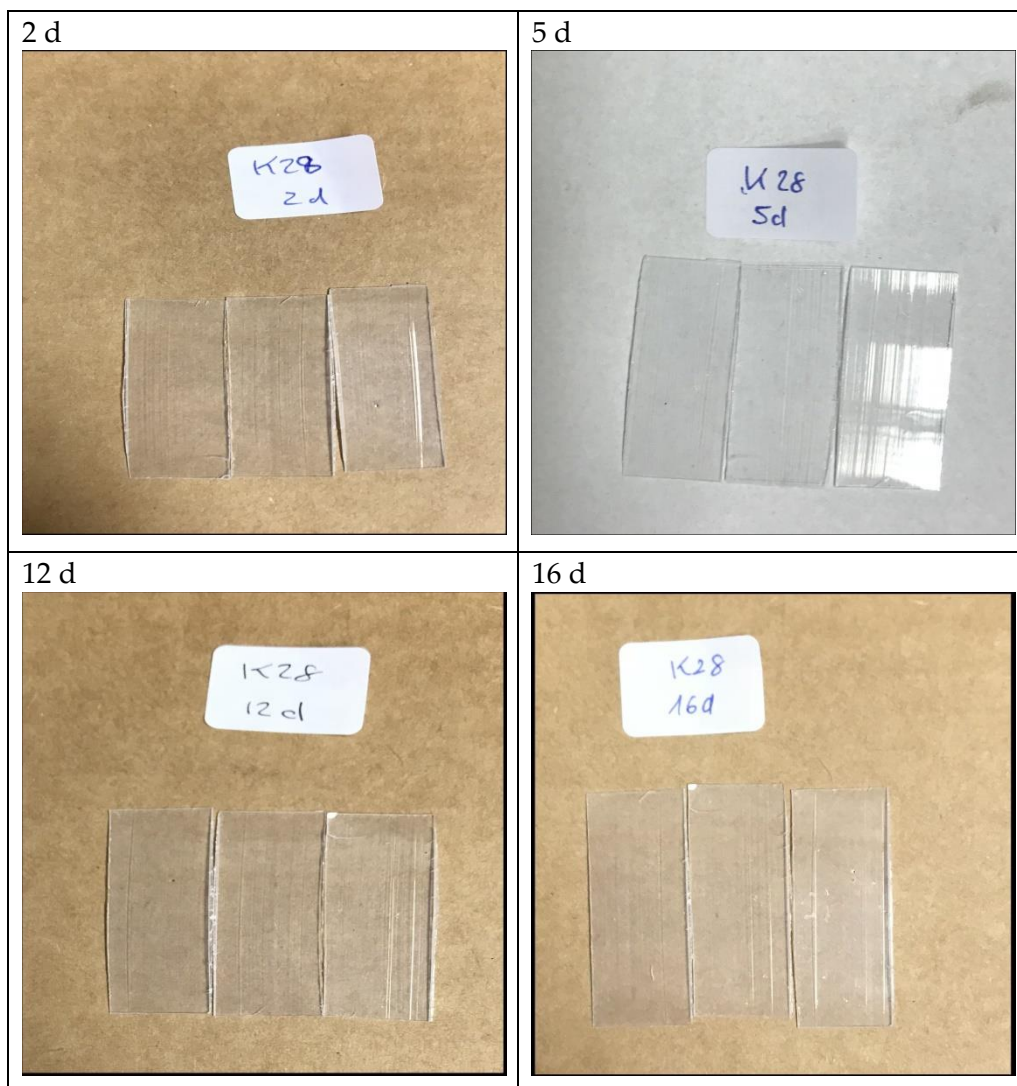


127 d



6 Contact with 3% Acetic acid

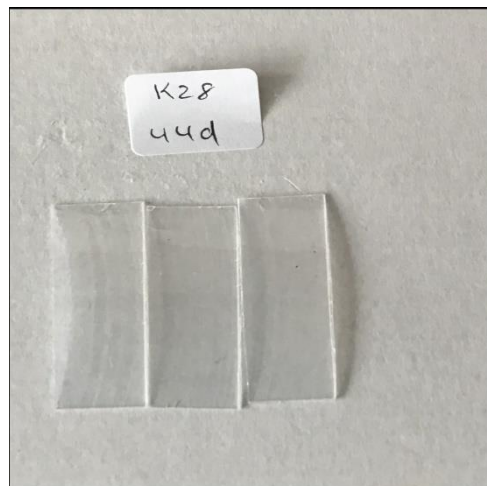
6.1 3% Acetic acid at 60 °C



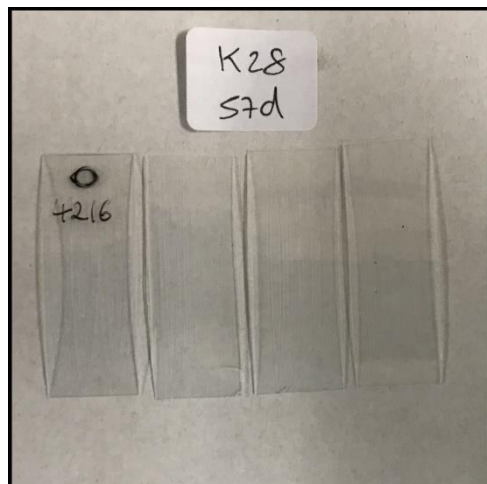
22 d



44 d



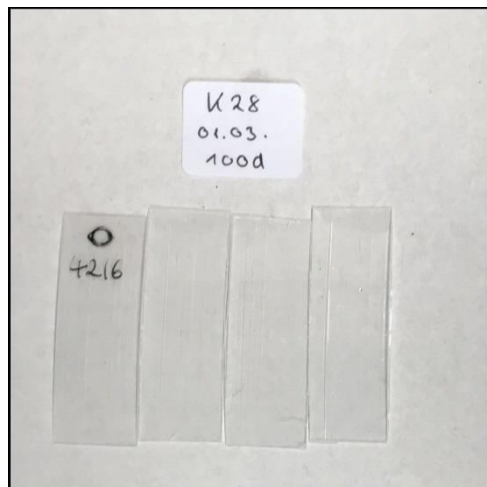
57 d



72 d



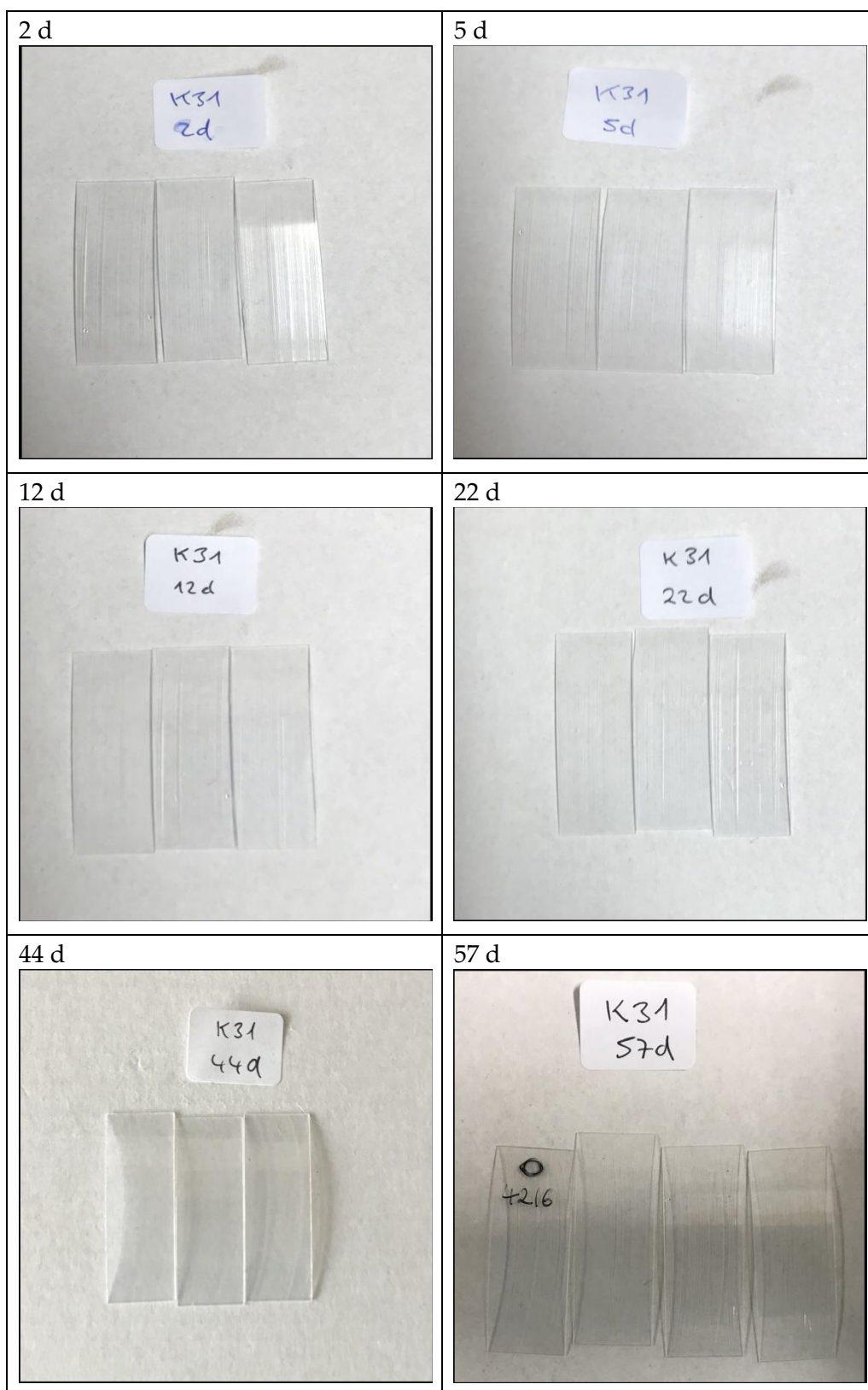
100 d



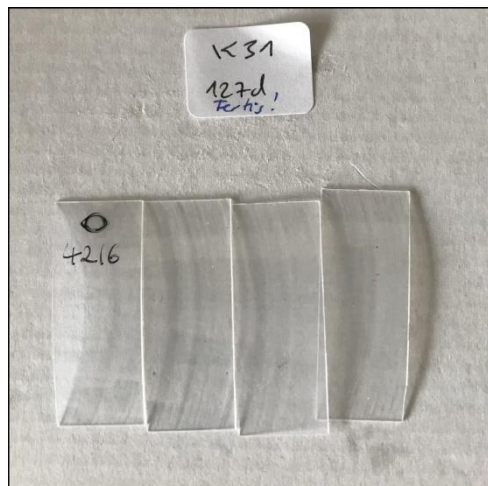
127 d



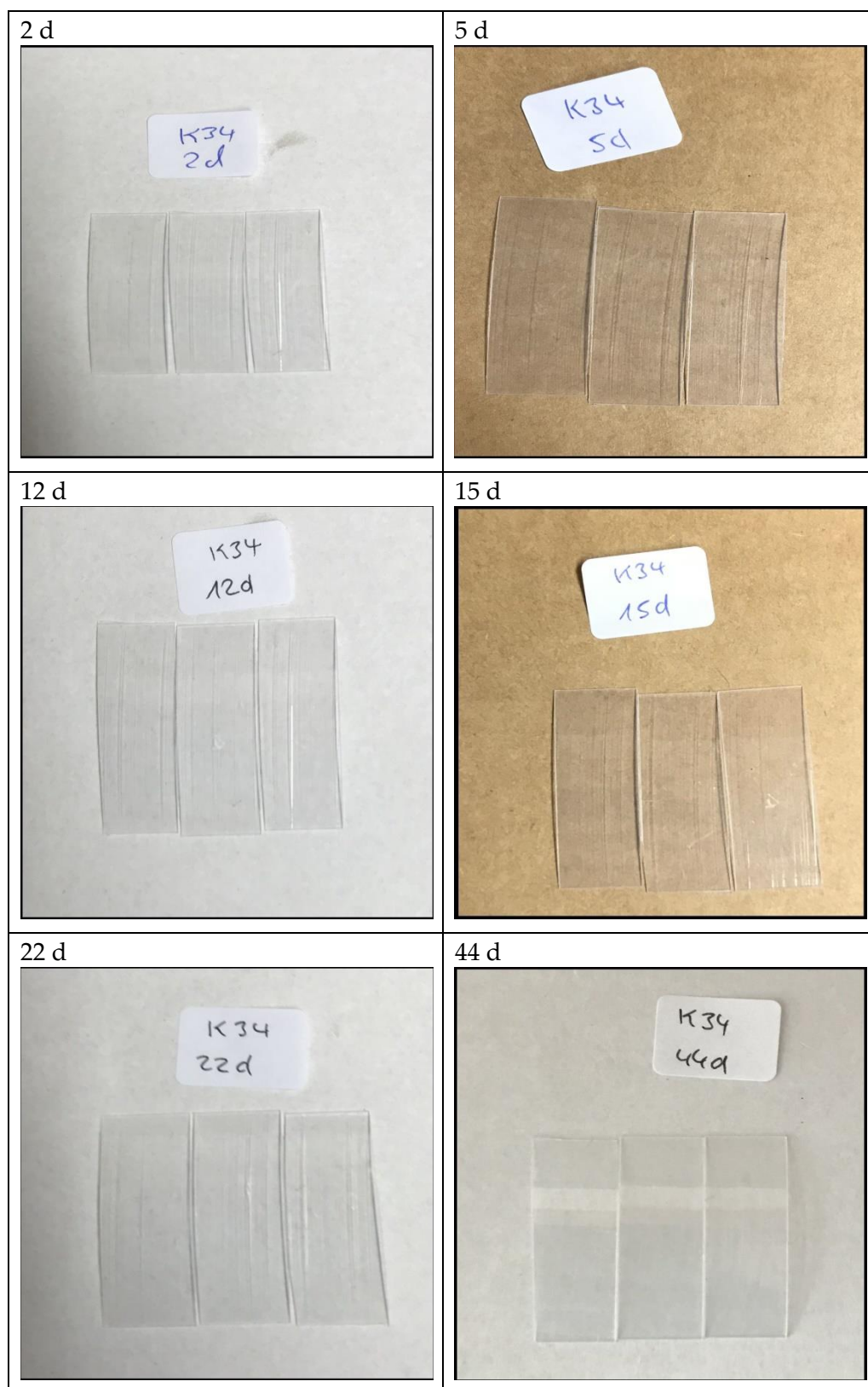
6.2 3% Acetic acid at 40 °C



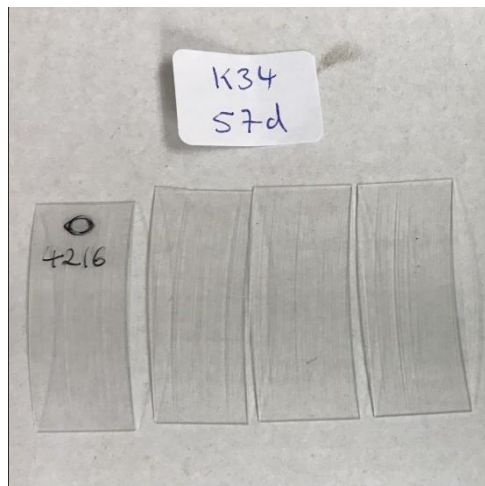
127 d



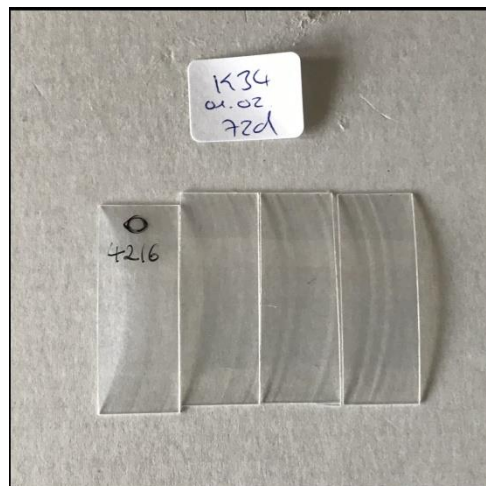
6.3 3% Acetic acid at 20 °C



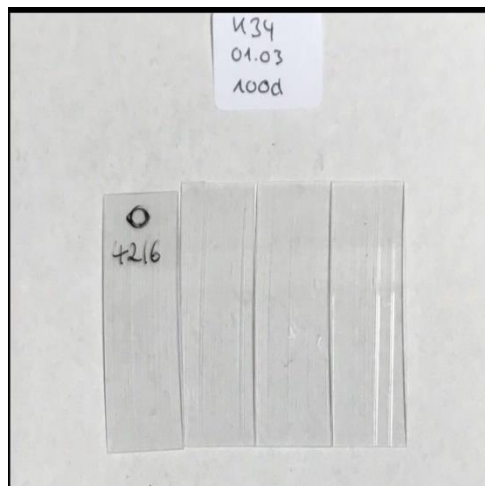
57 d



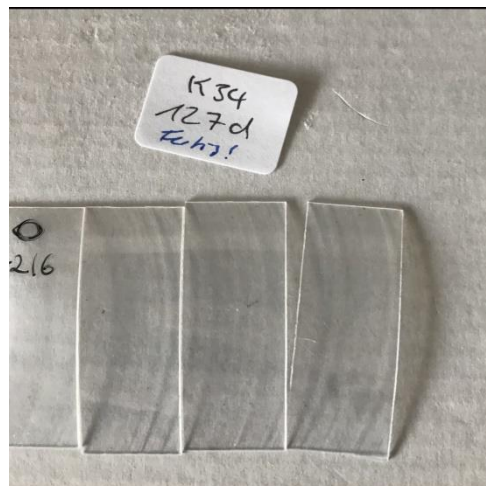
72 d



100 d

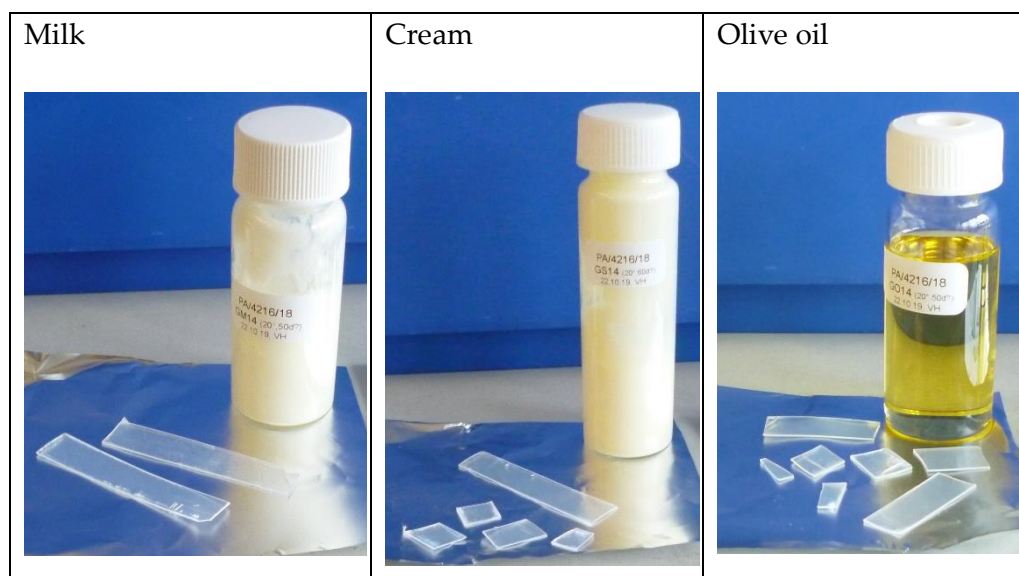


127 d

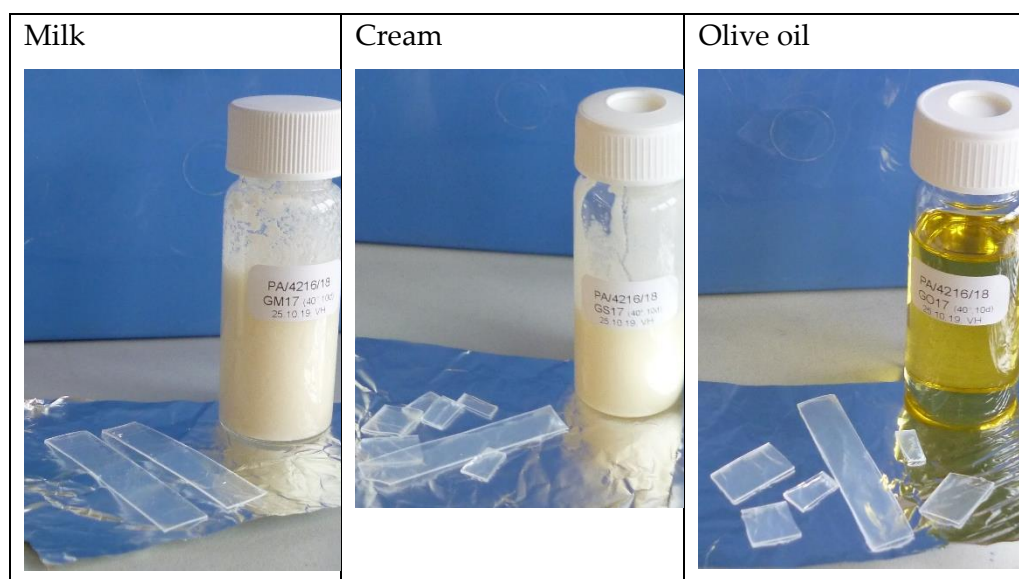


7 Contact with real foods

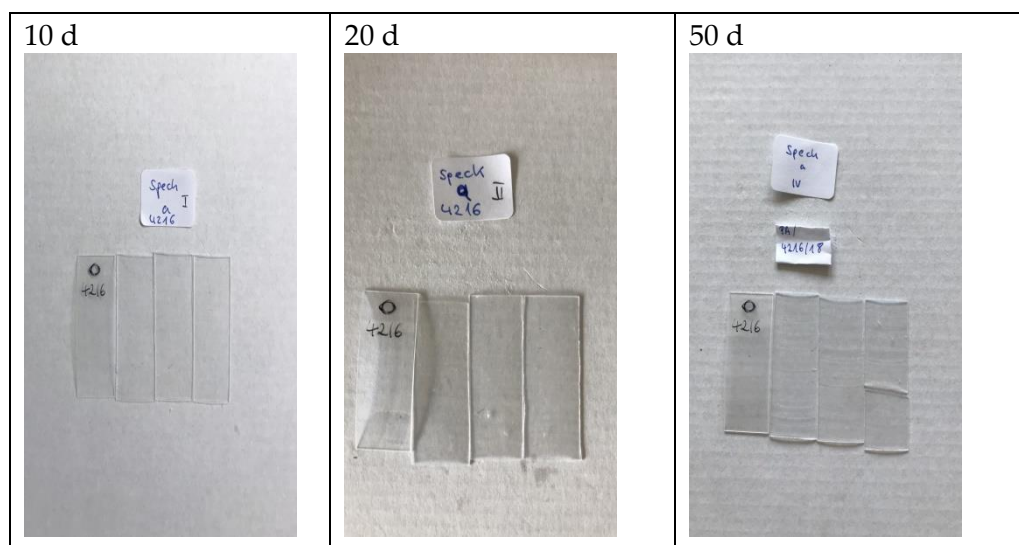
7.1 Milk, cream and olive oil 60 d at 20 °C



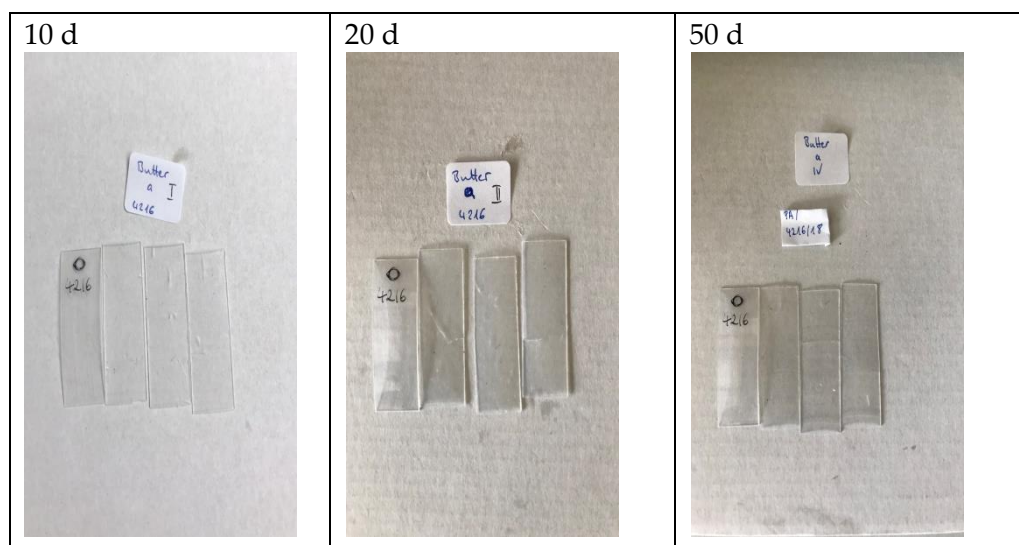
7.2 Milk, cream and olive oil 10 d at 40 °C



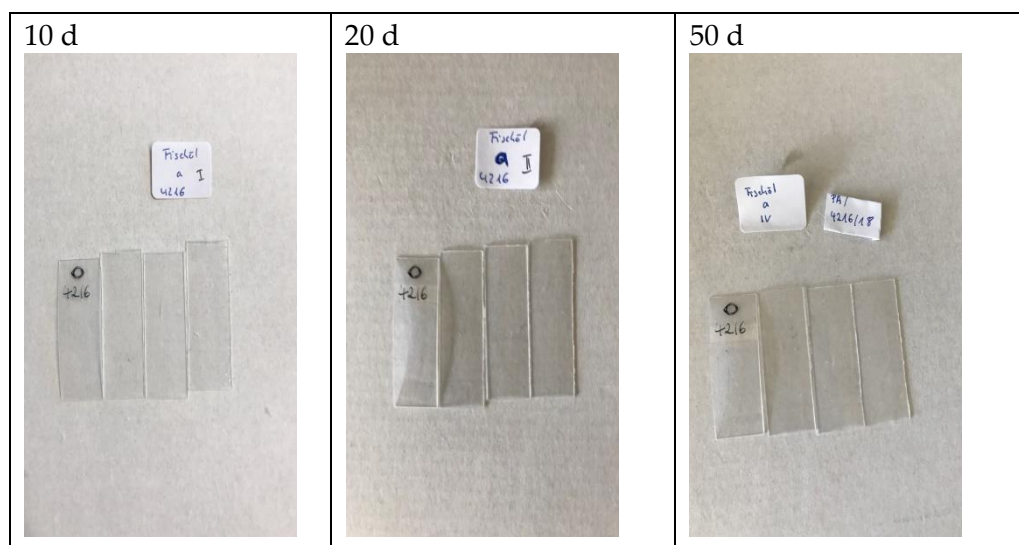
7.3 Lard at 5 °C



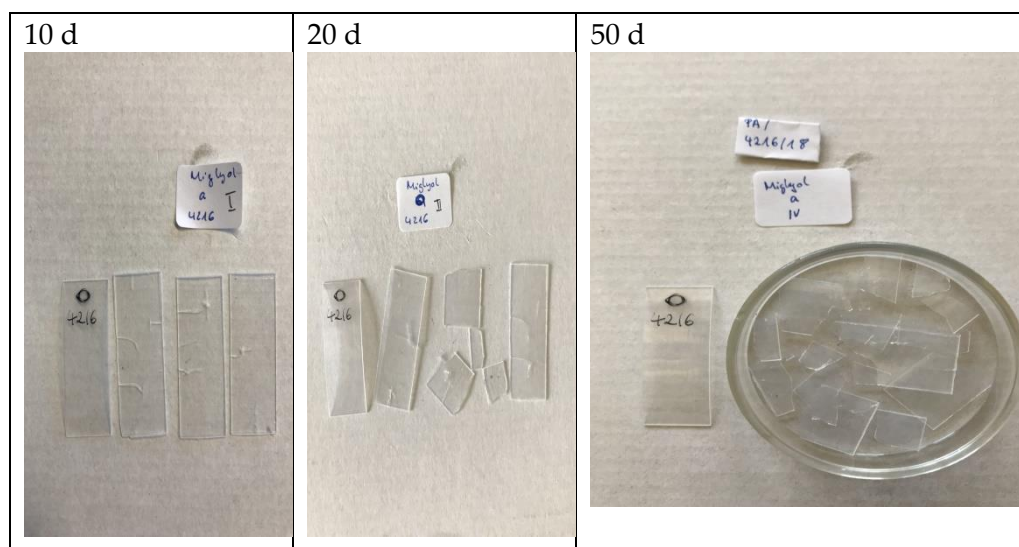
7.4 Butter at 5 °C



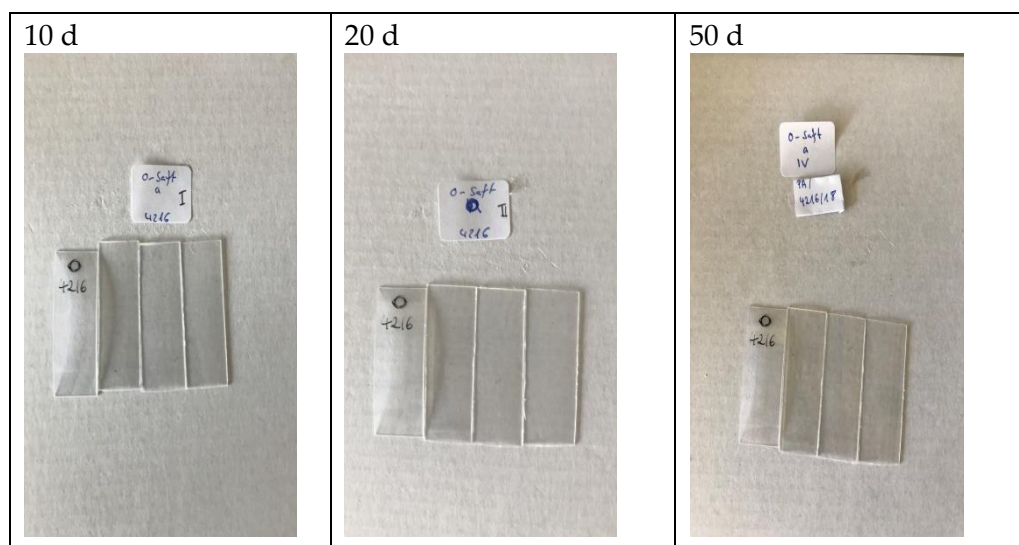
7.5 Fish oil at 20 °C



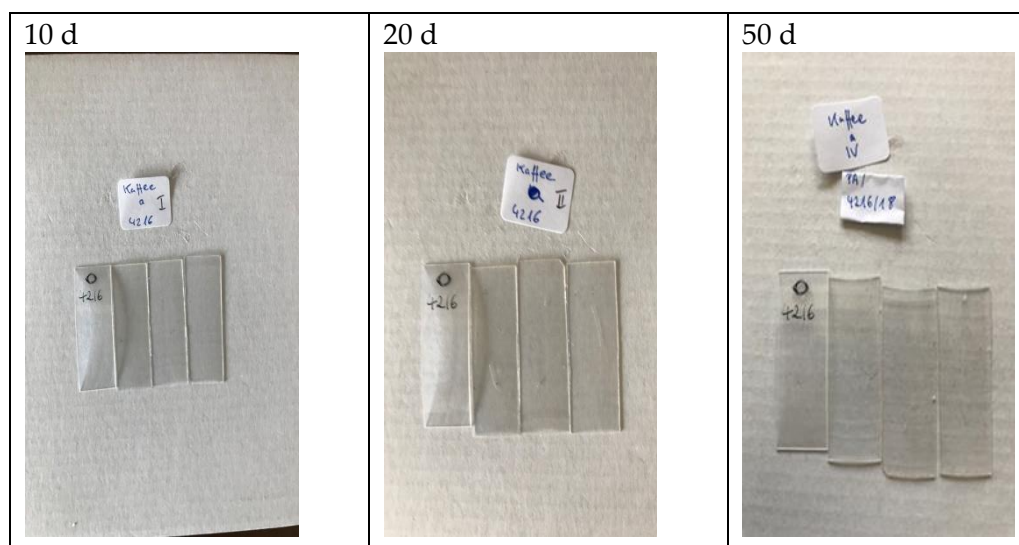
7.6 Miglyol® 812 at 20 °C



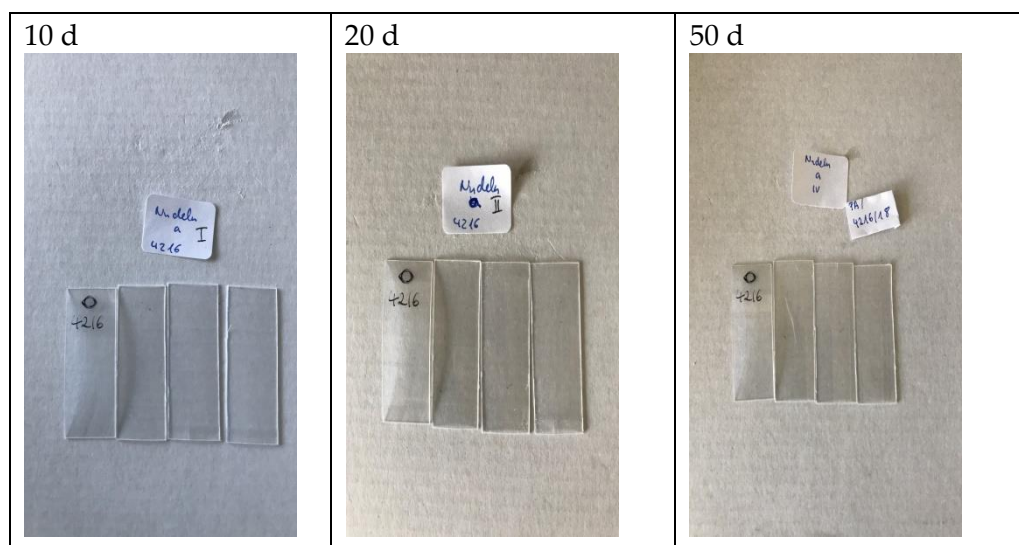
7.7 Clear orange juice at 20 °C



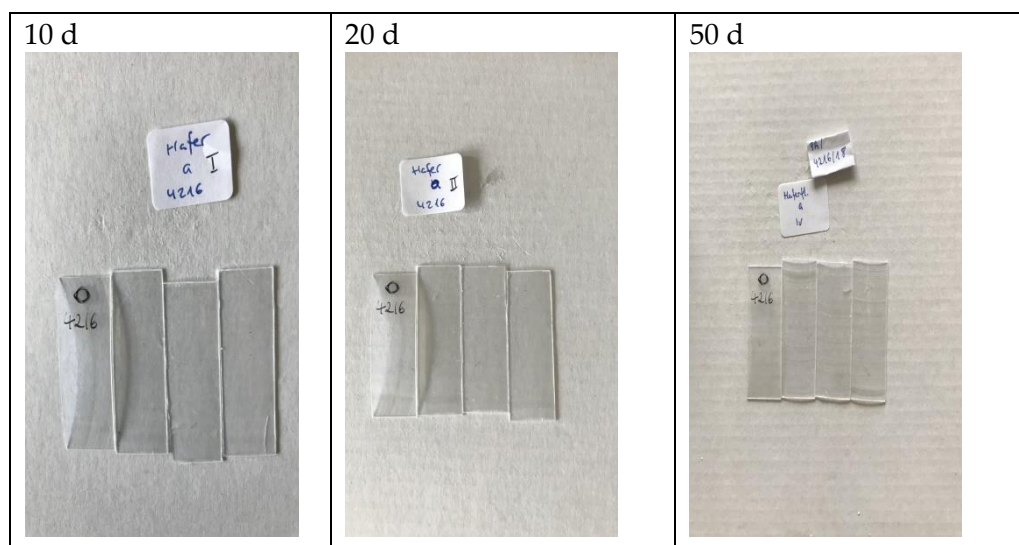
7.8 Ground coffee beans at 20 °C



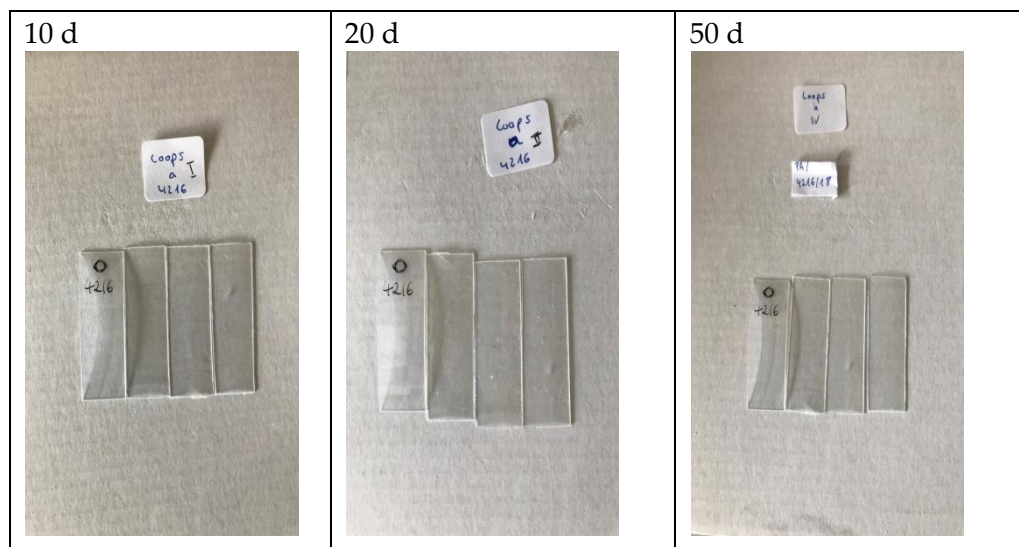
7.9 Noodles at 20 °C



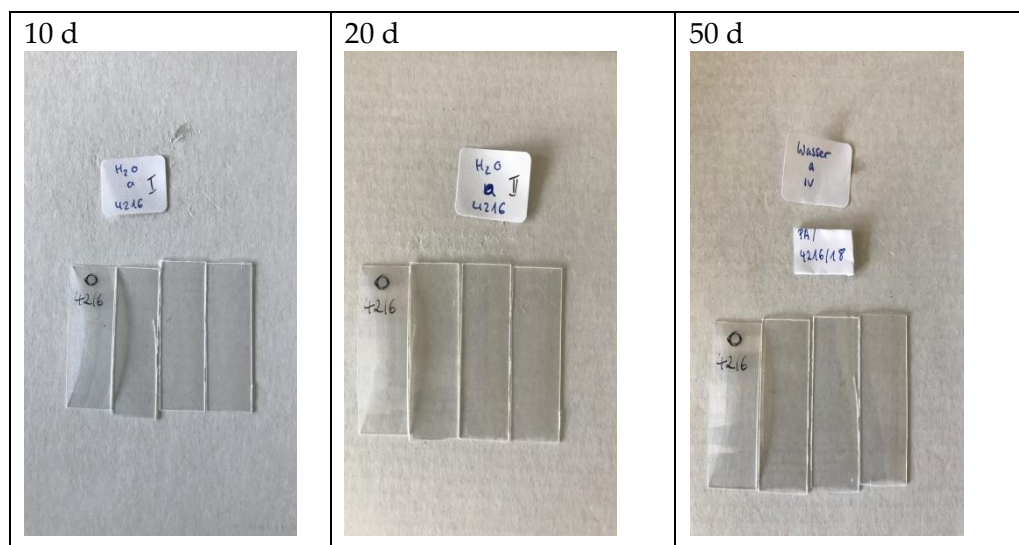
7.10 Oat flakes at 20 °C



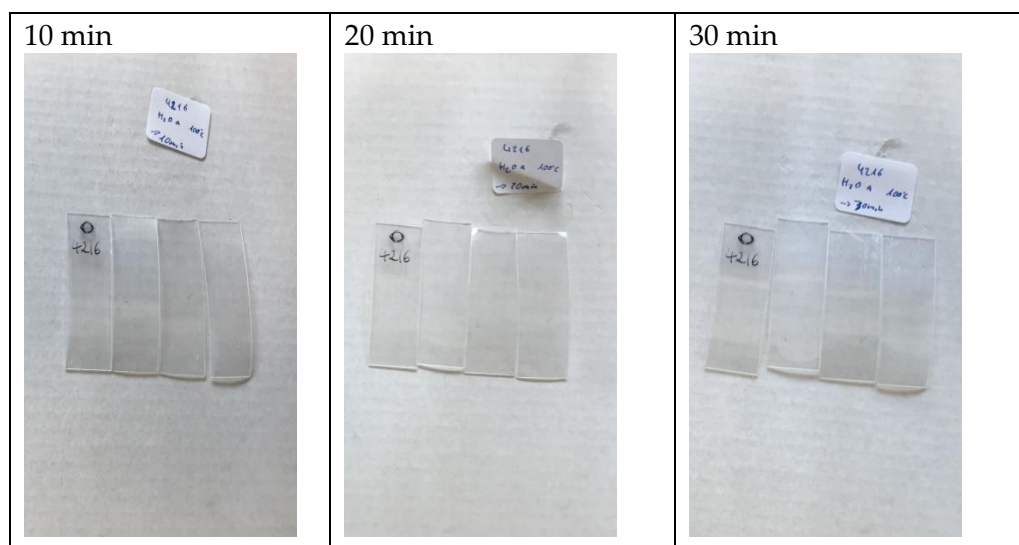
7.11 Wheat loops at 20 °C



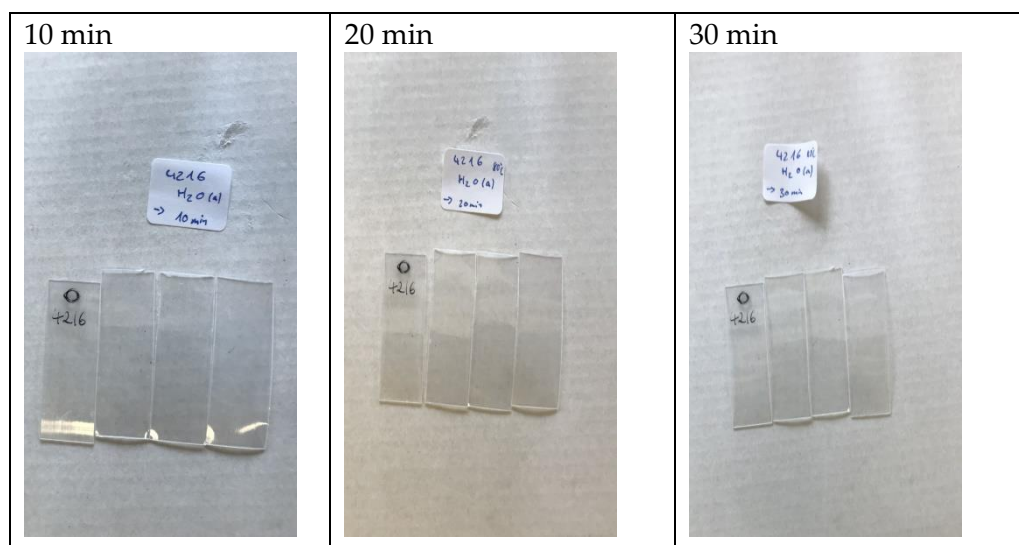
7.12 Water at 20 °C



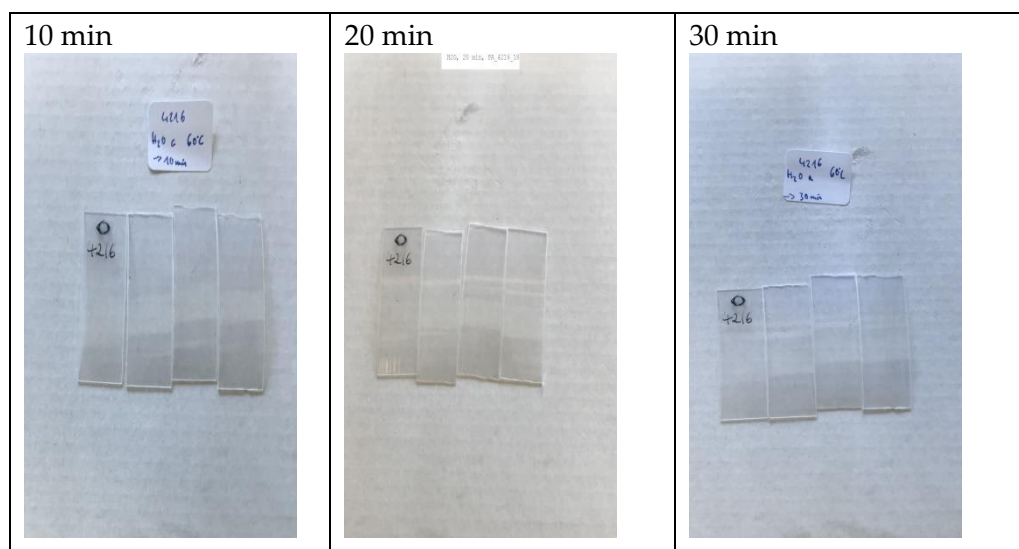
7.13 Water at 100 °C



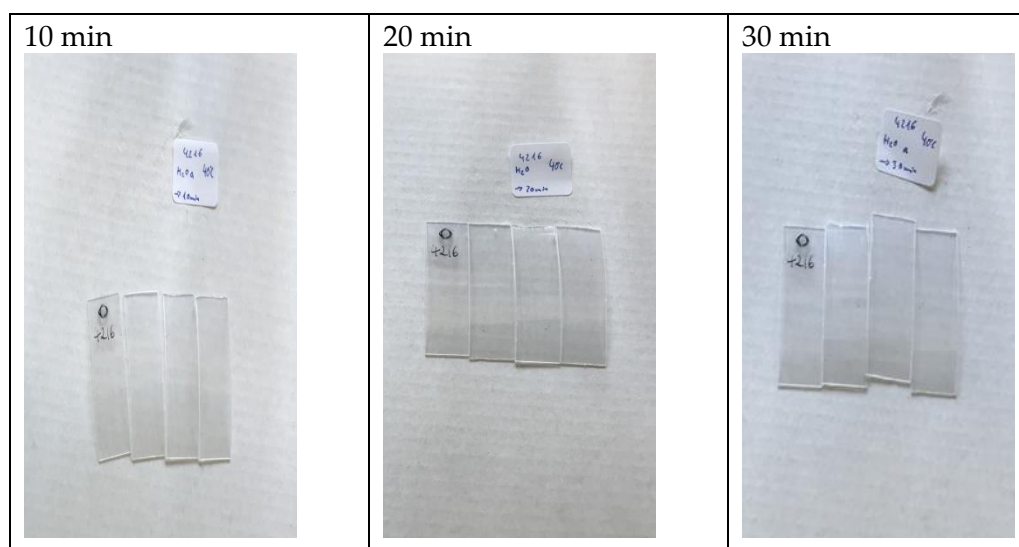
7.14 Water at 80 °C



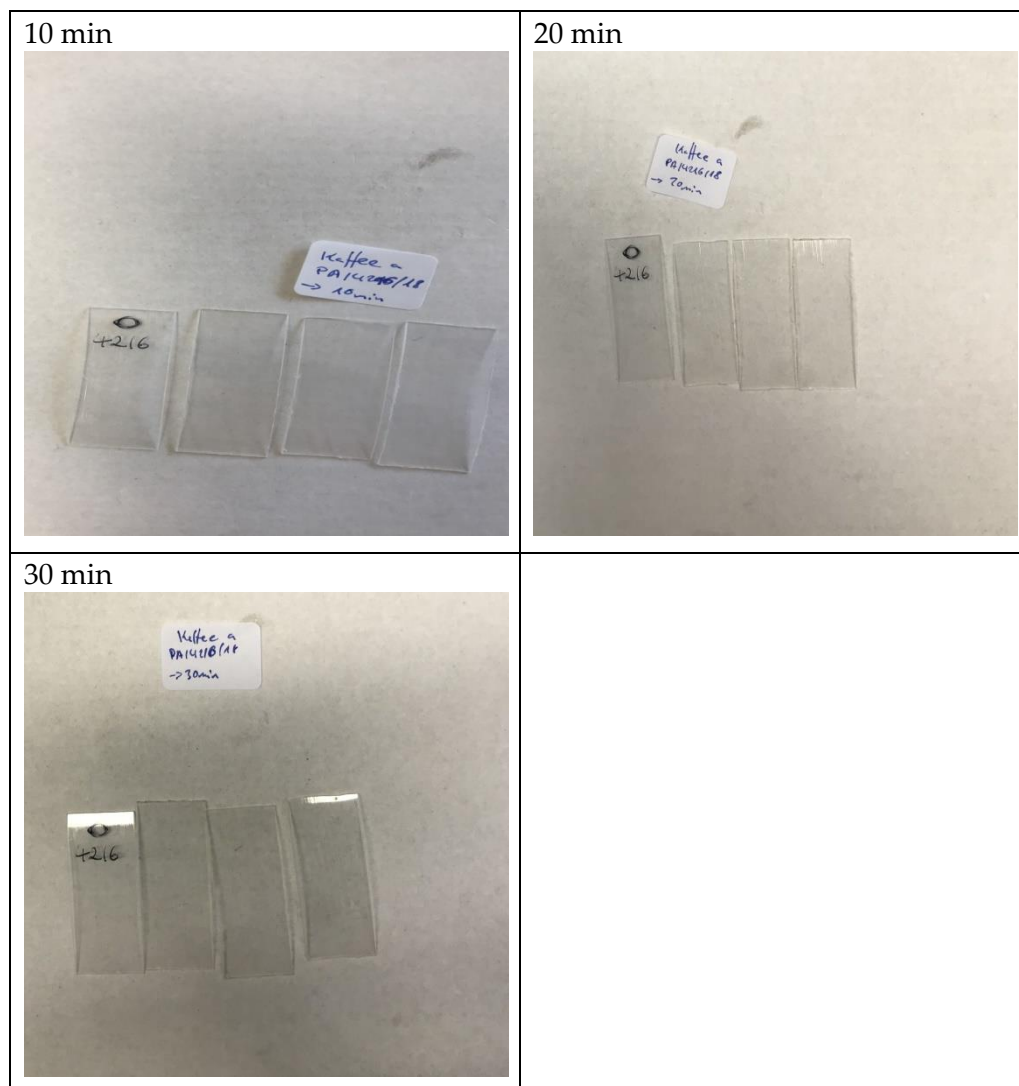
7.15 Water at 60 °C



7.16 Water at 40 °C



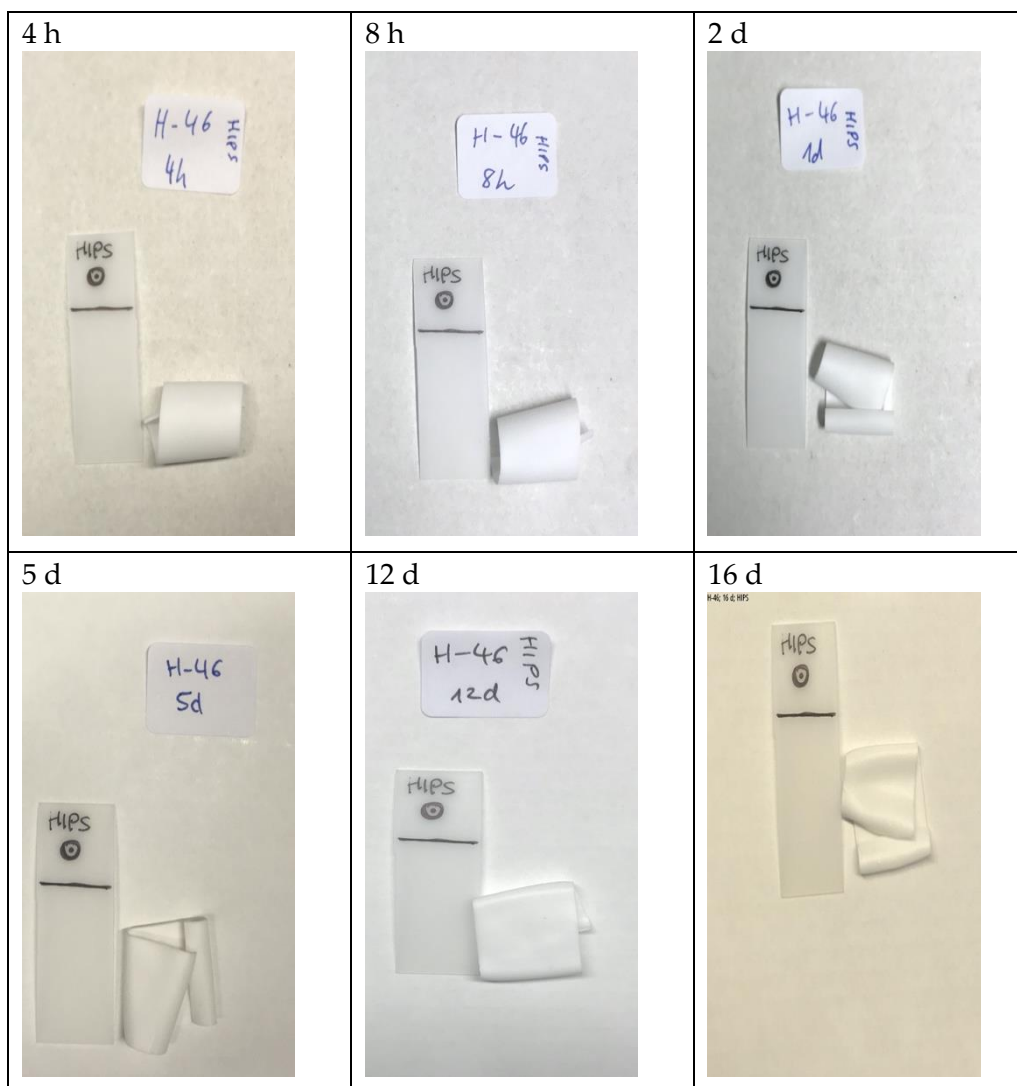
7.17 Brewed coffee at 90 °C

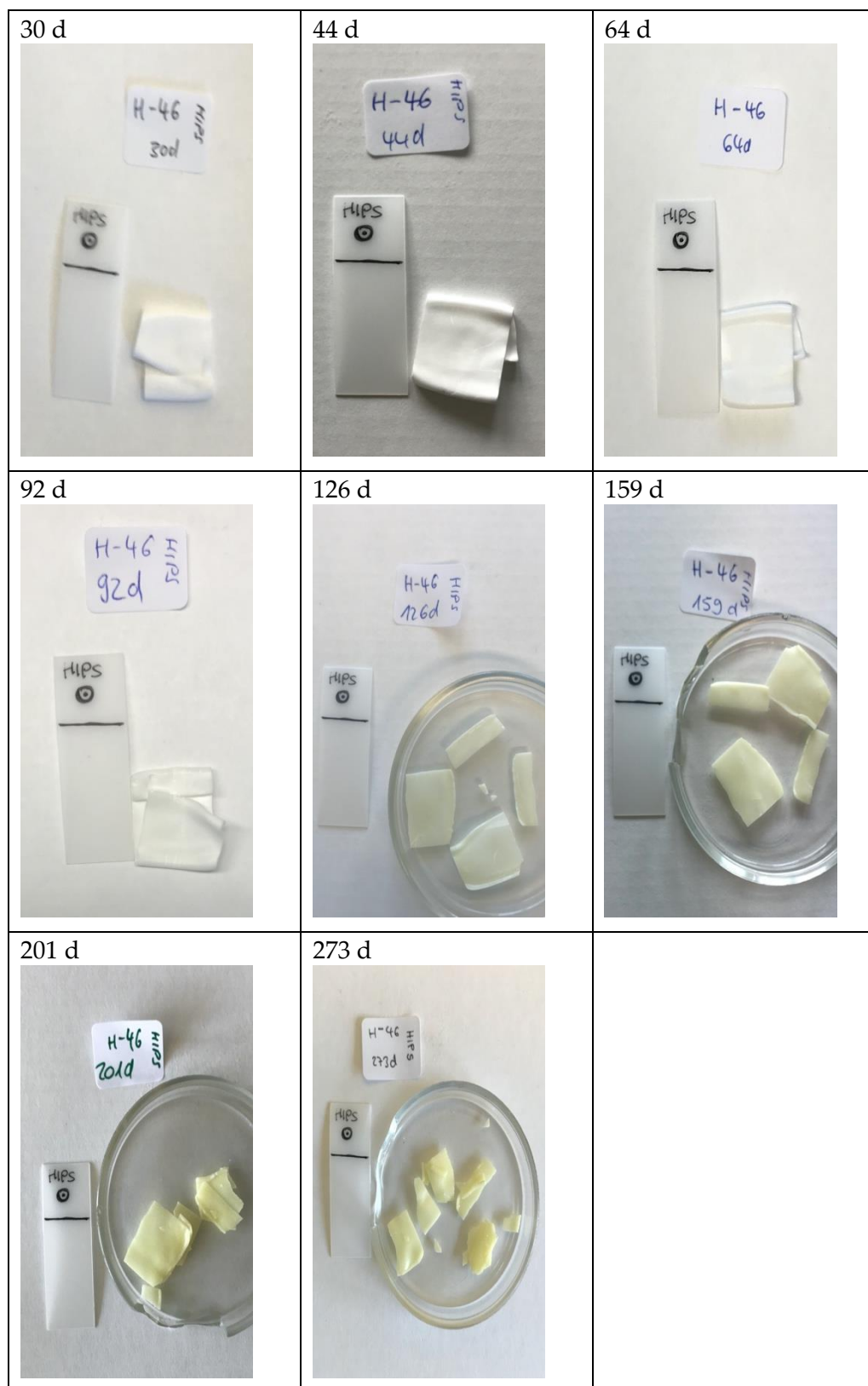


HIPS (high impact polystyrene)

8 Contact with Isooctane

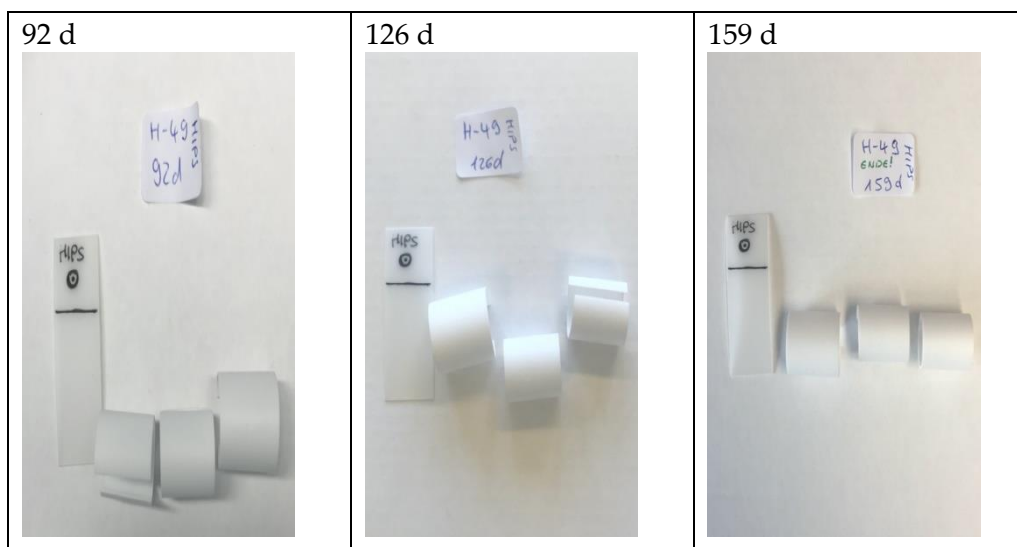
8.1 Isooctane at 60 °C





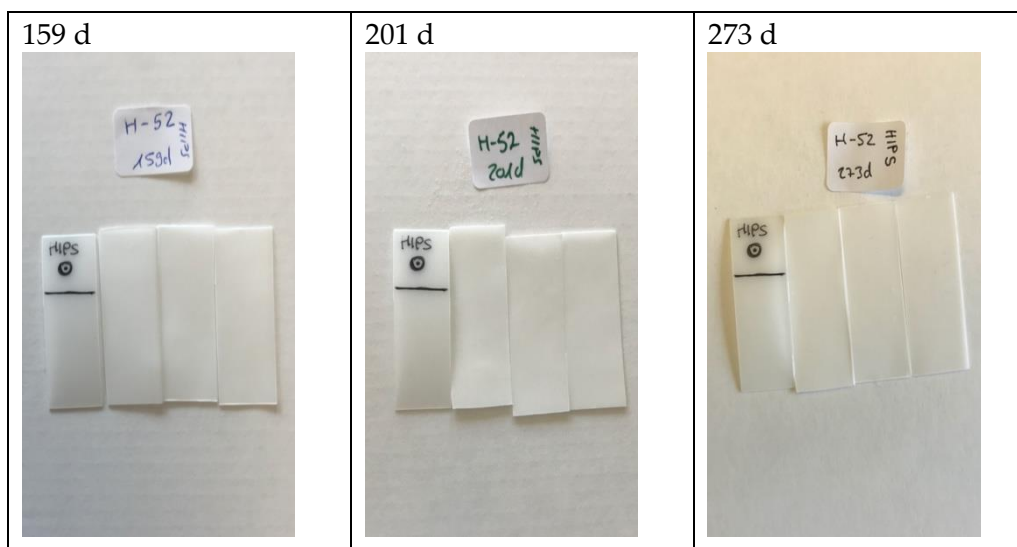
8.2 Isooctane at 40 °C





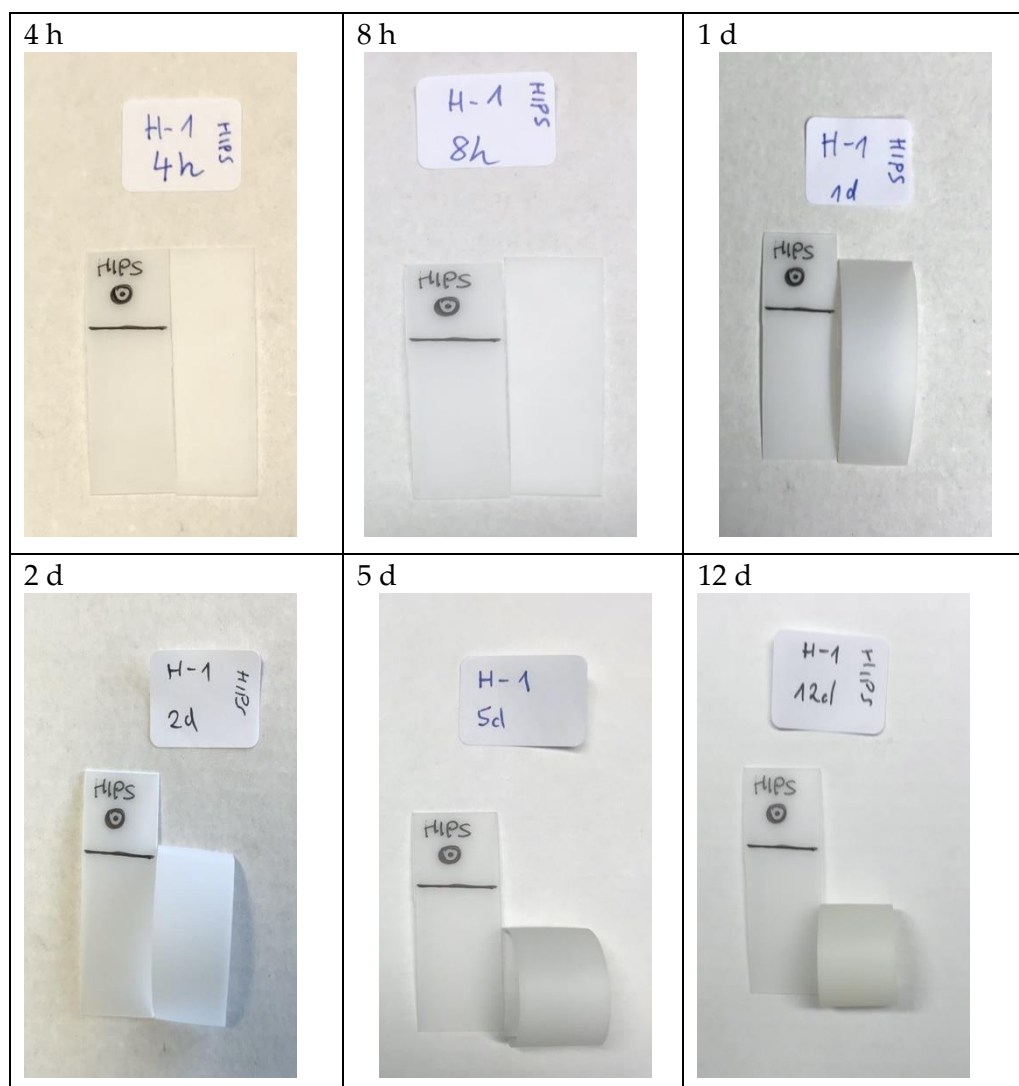
8.3 Isooctane at 20 °C

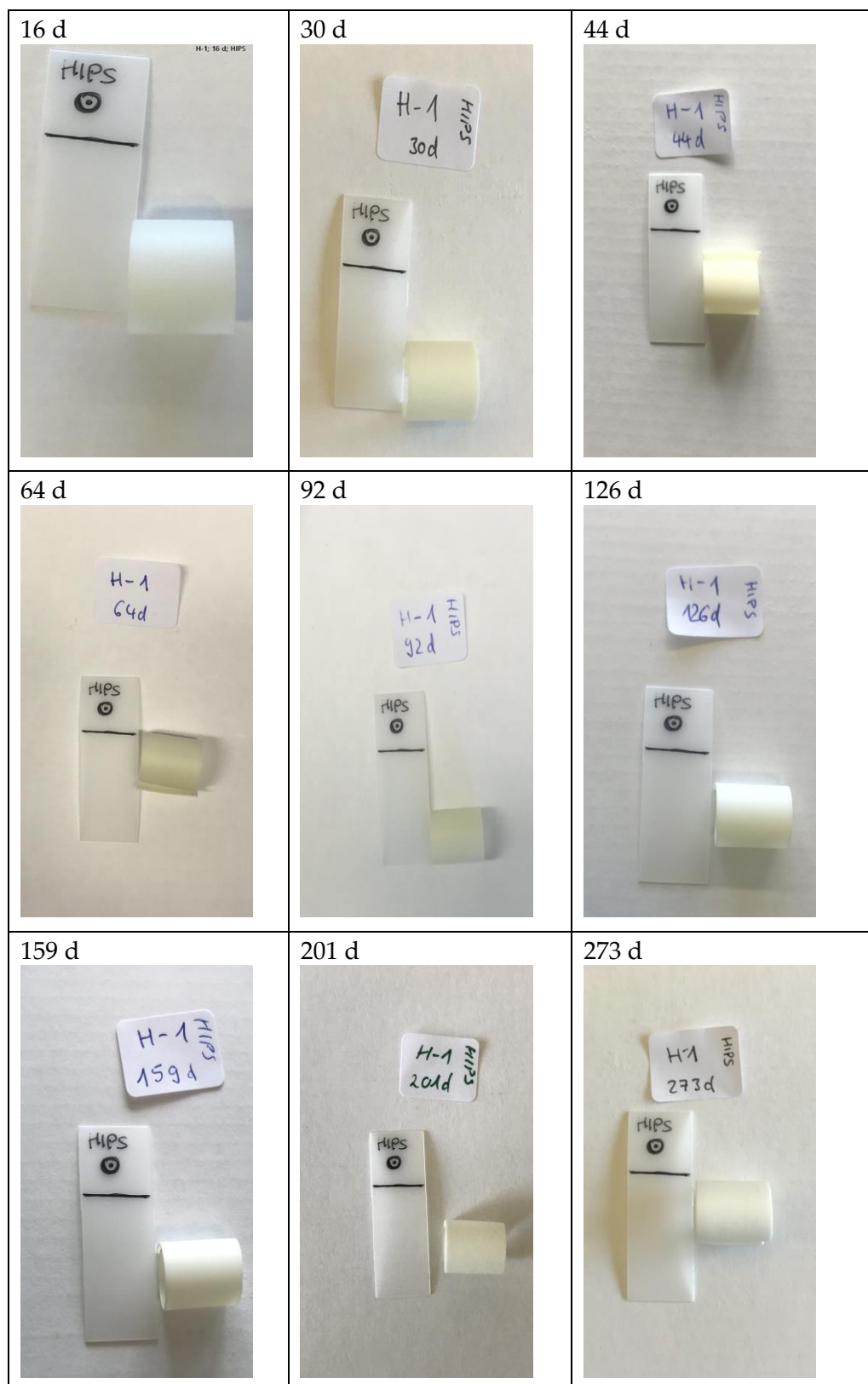




9 Contact with 95% Ethanol

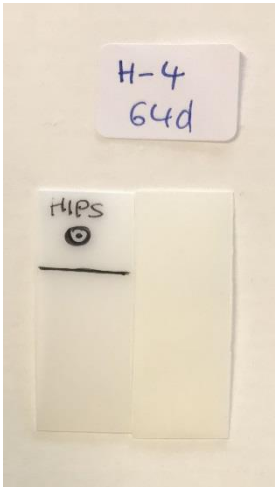
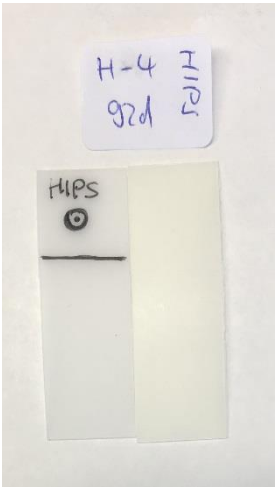


9.1 95% Ethanol at 60 °C





9.2 95% Ethanol at 40 °C



64 d 	92 d 	126 d 
159 d 		

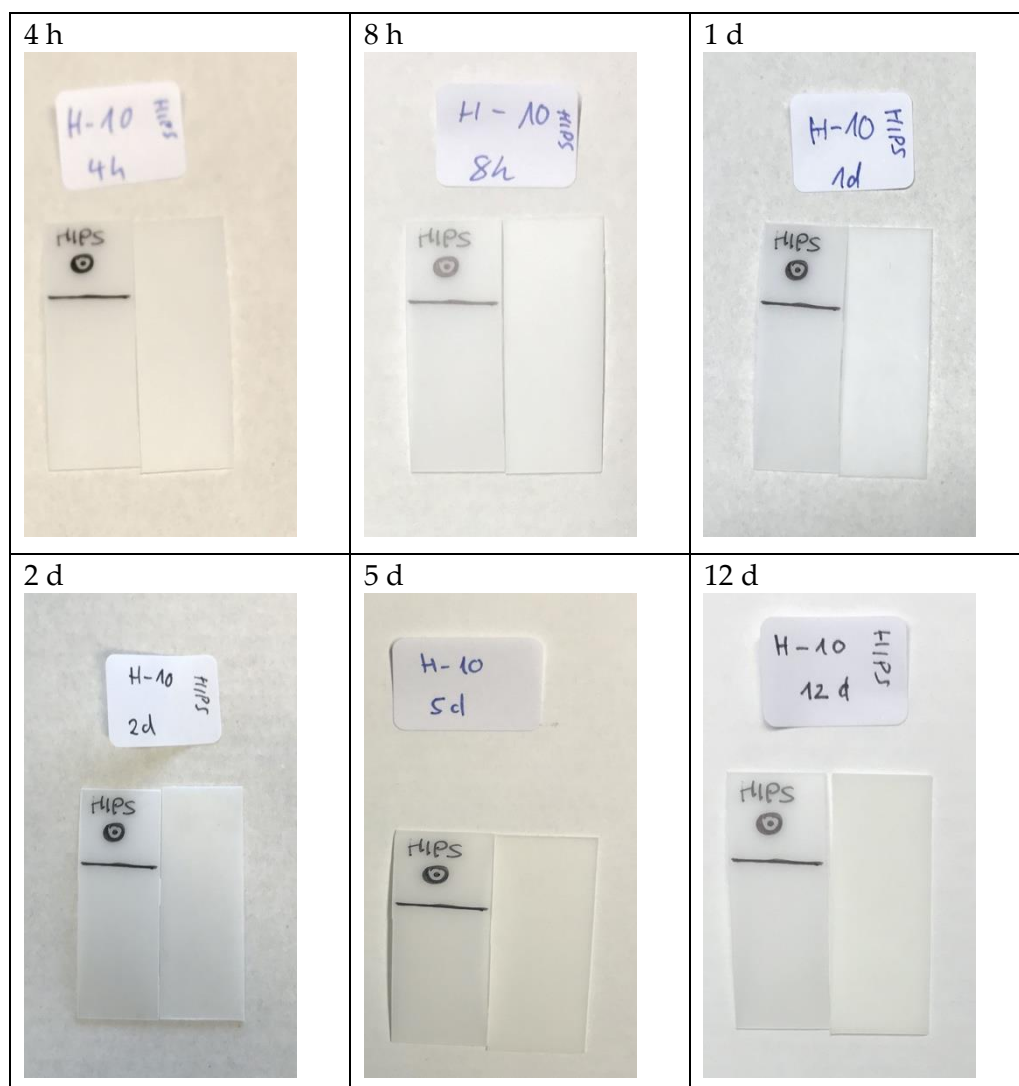
9.3 95% Ethanol at 20 °C



159 d		
		

10 Contact with 50% Ethanol



10.1 50% Ethanol at 60 °C





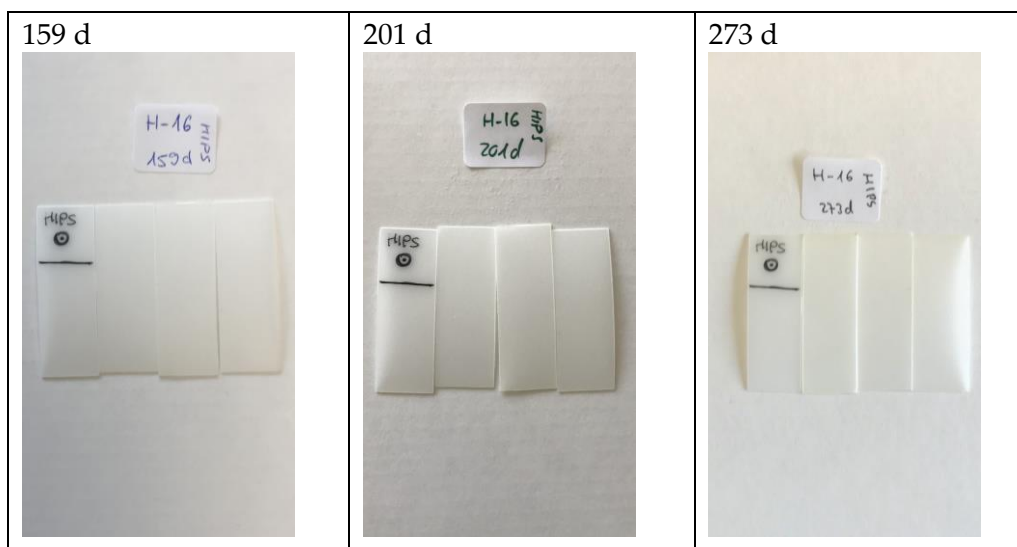
10.2 50% Ethanol at 40 °C



<p>126 d</p> 	<p>159 d</p> 	
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10.3 50% Ethanol at 20 °C

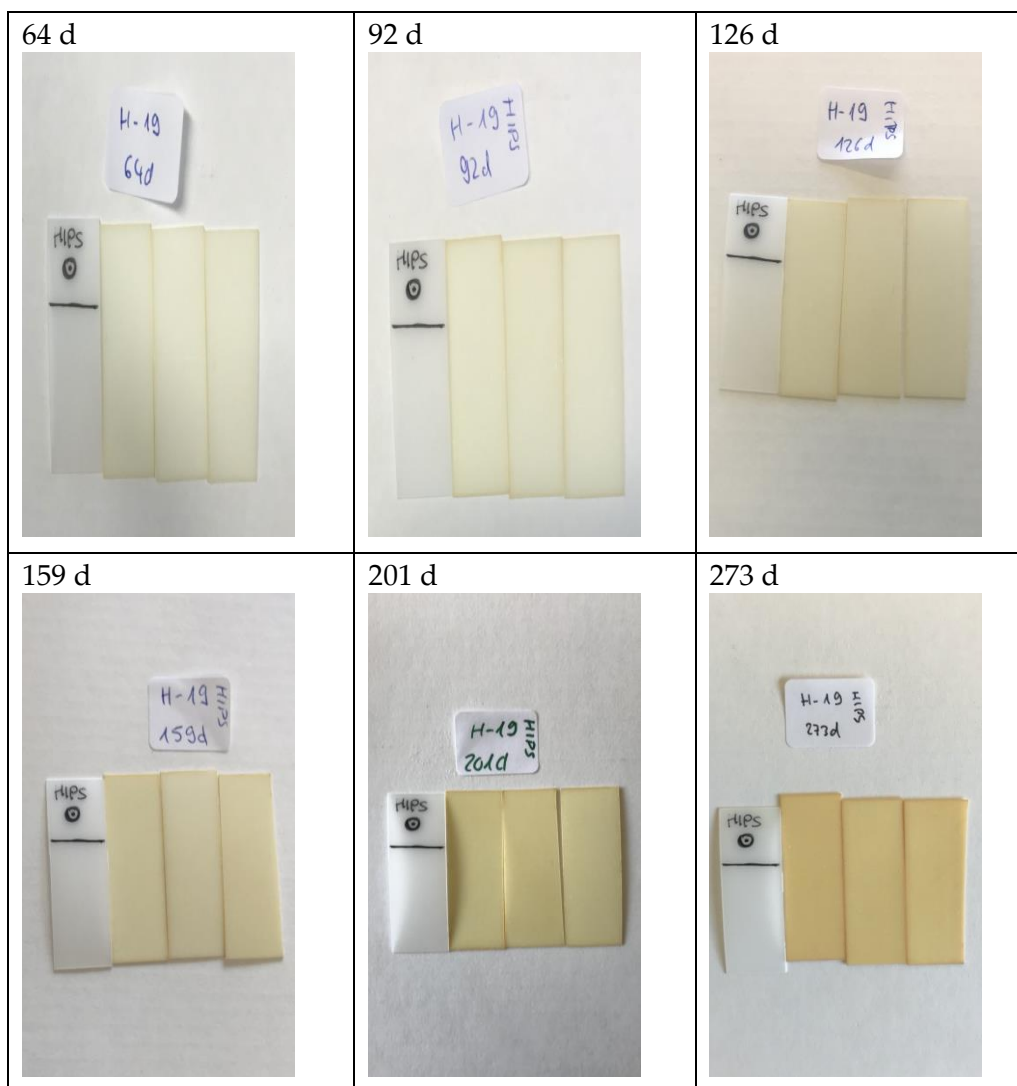




11 Contact with 20% Ethanol


11.1 20% Ethanol at 60 °C





11.2 20% Ethanol at 40 °C



159 d 		
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11.3 20% Ethanol at 20 °C



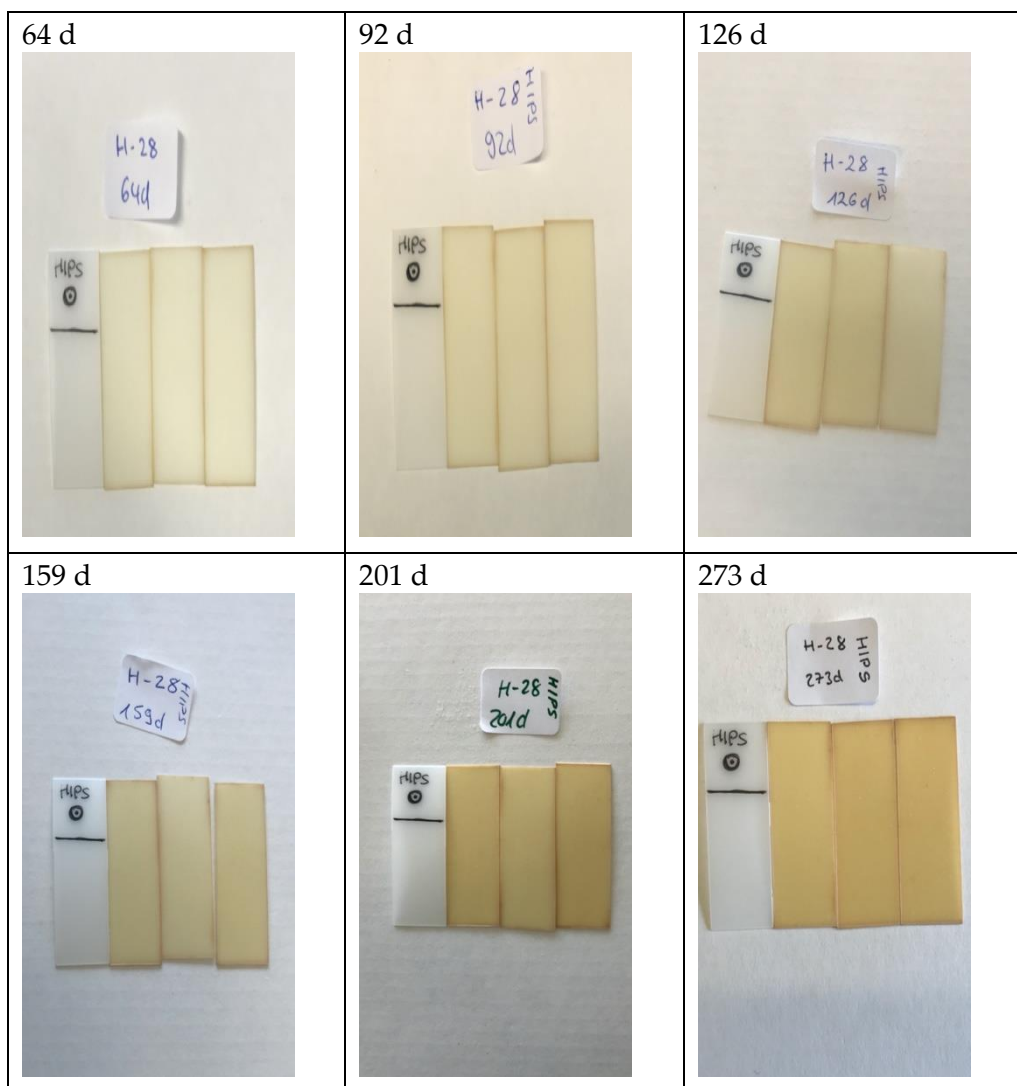
159 d



12 Contact with 10% Ethanol

12.1 10% Ethanol at 60 °C





12.2 10% Ethanol at 40 °C



<p>159 d</p> 		
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12.3 10% Ethanol at 20 °C

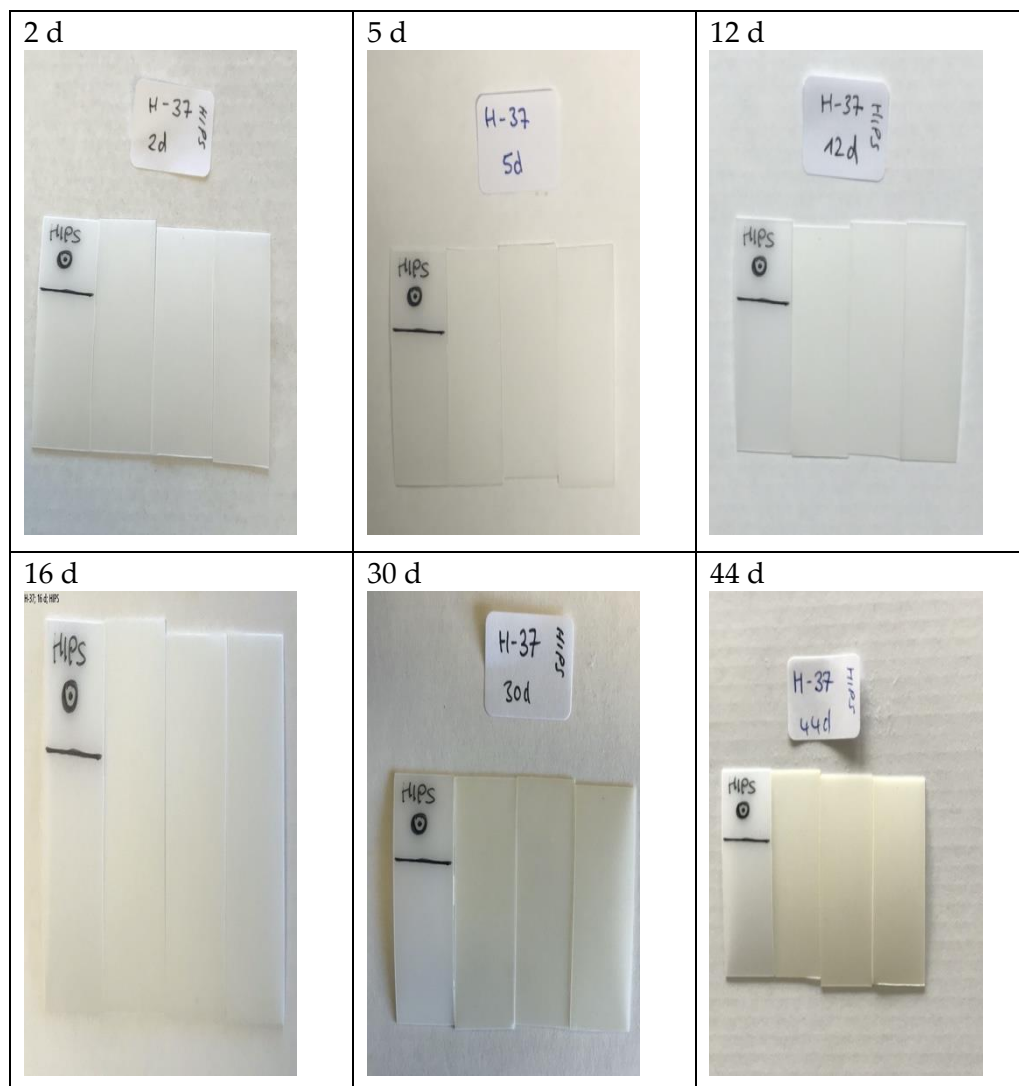


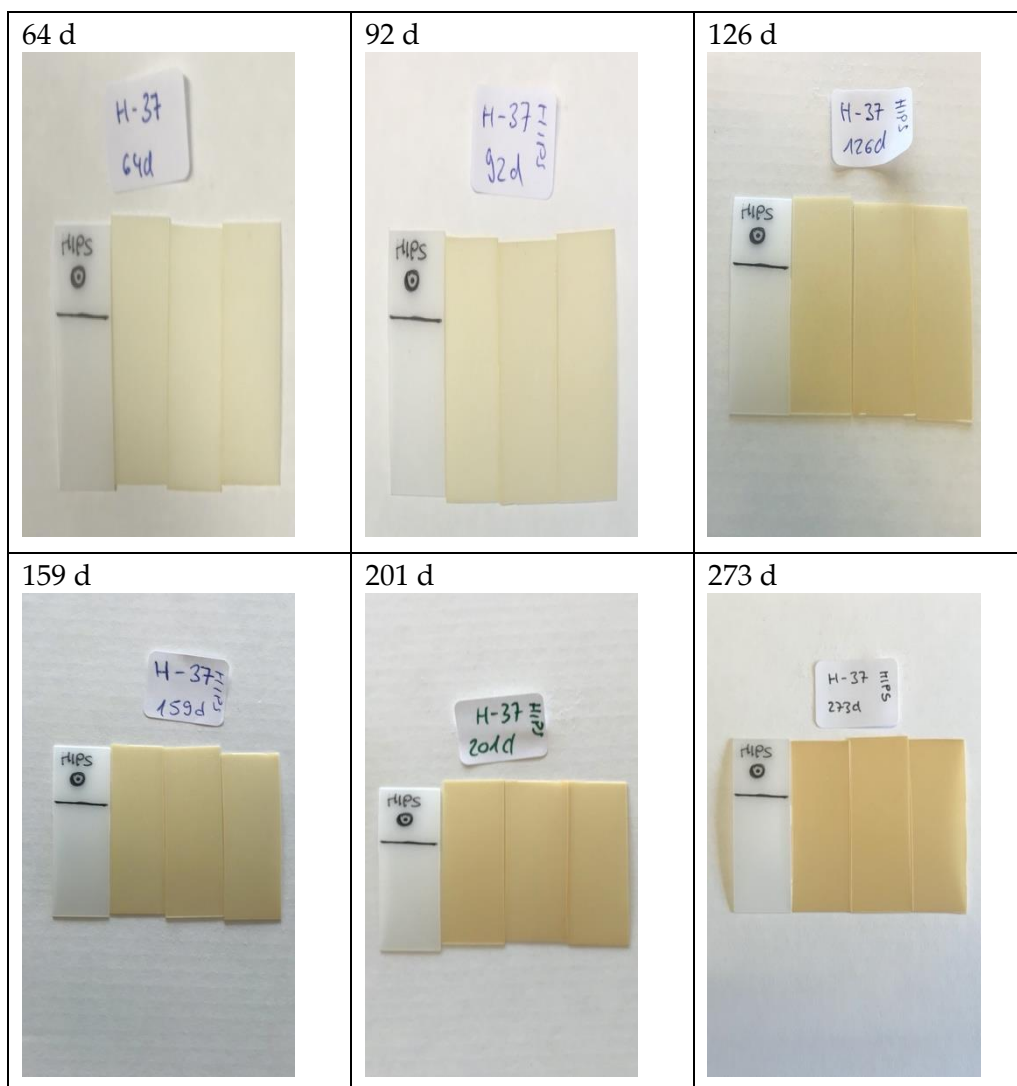
159 d



13 Contact with 3% acetic acid

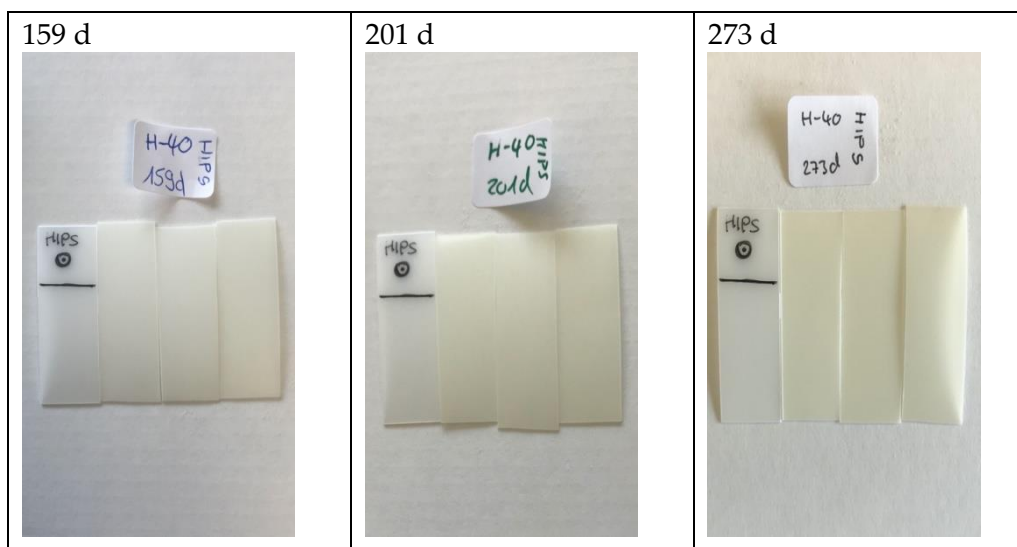
13.1 3% Acetic acid at 60 °C





13.2 3% Acetic acid at 40 °C





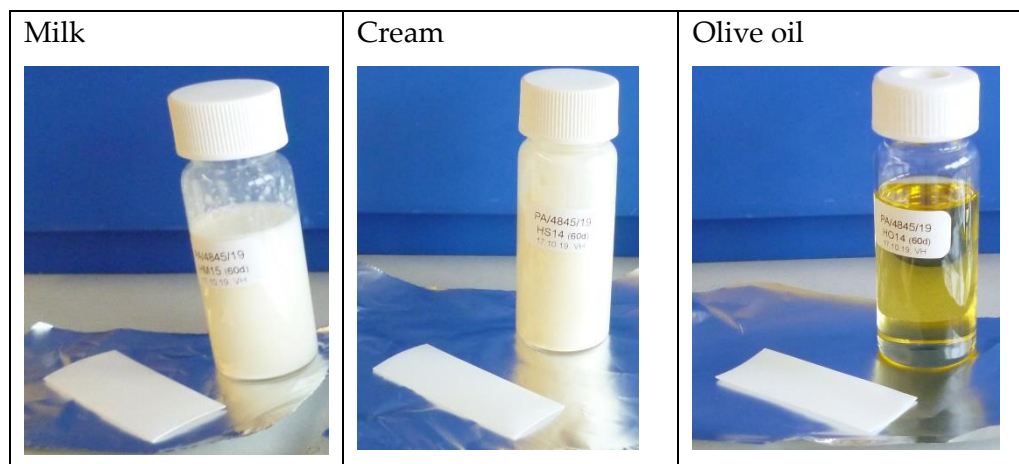
13.3 3% Acetic acid at 20 °C



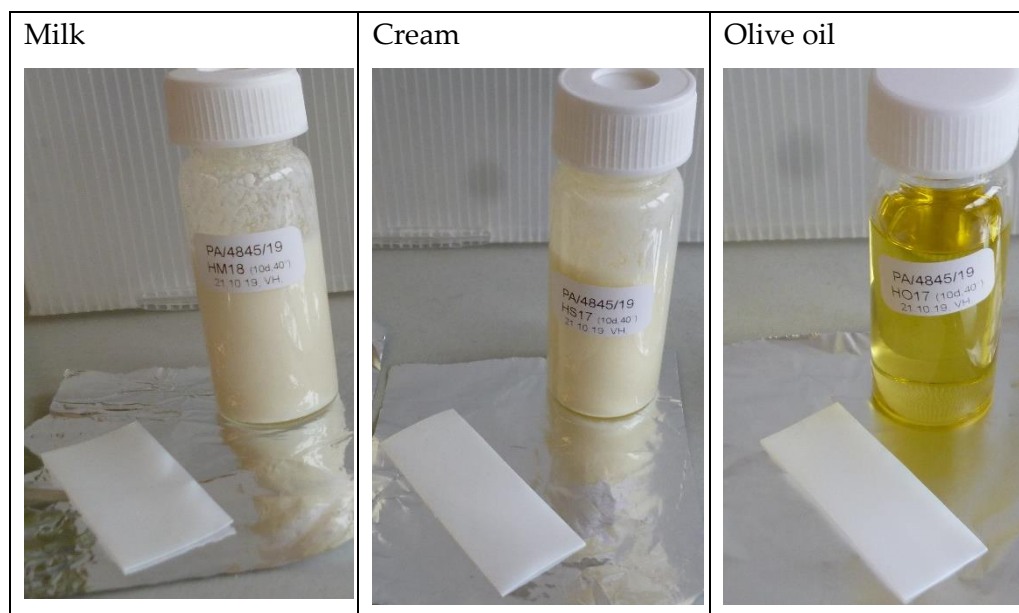
159 d		
		

14 Contact with real foods

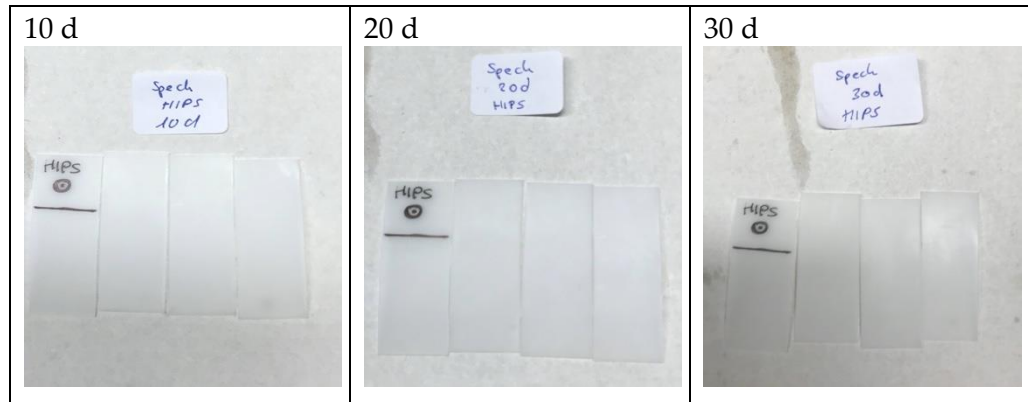
14.1 Milk, cream and olive oil 60 d at 20 °C



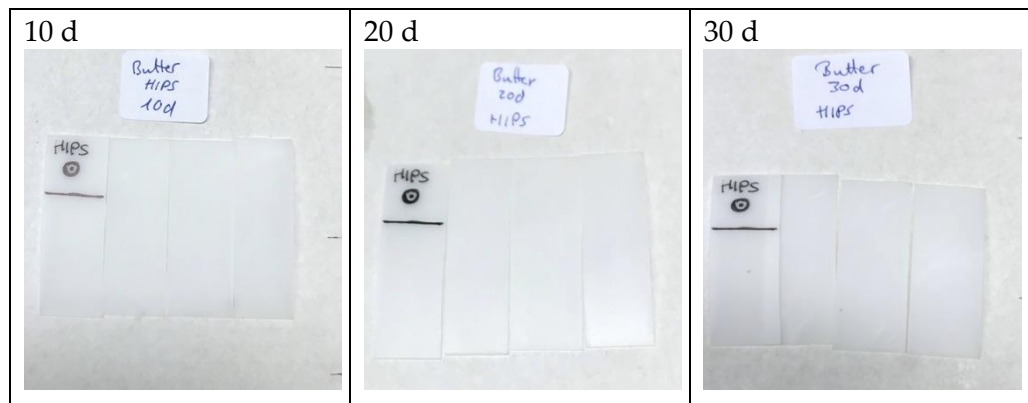
14.2 Milk, cream and olive oil 10 d at 40 °C



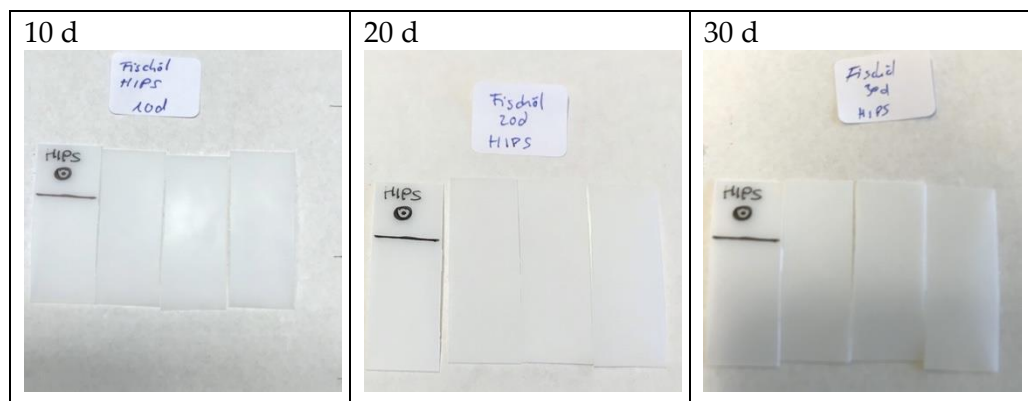
14.3 Lard at 5 °C



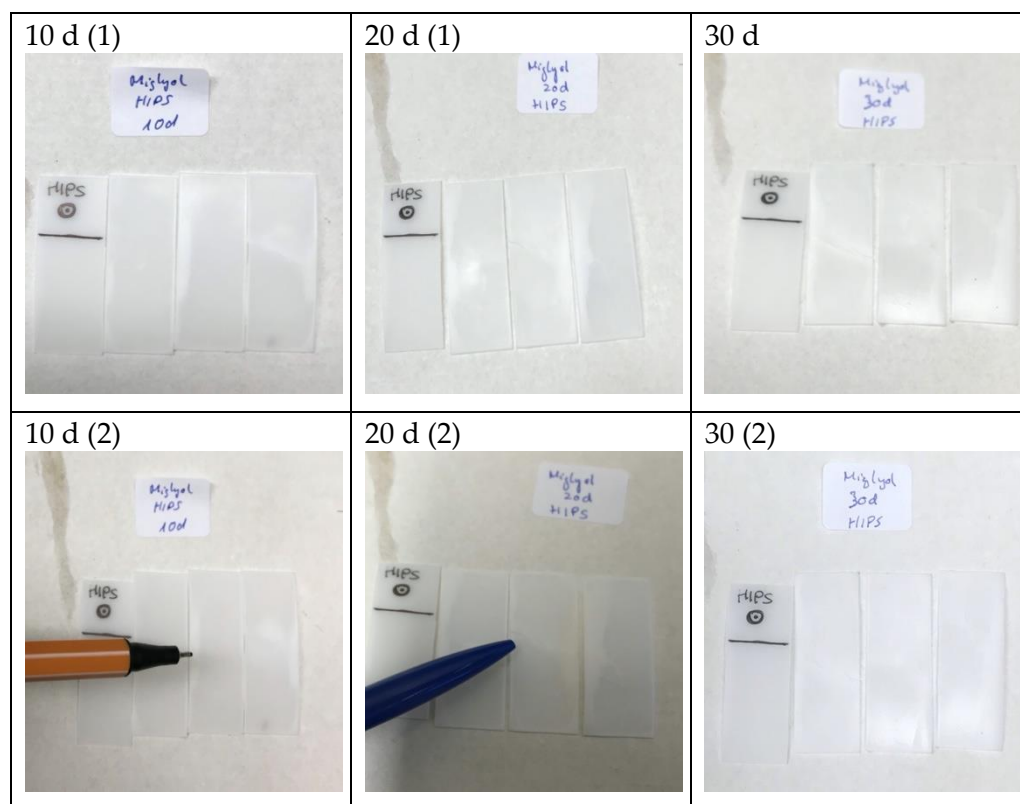
14.4 Butter at 5 °C



14.5 Fish oil at 20 °C

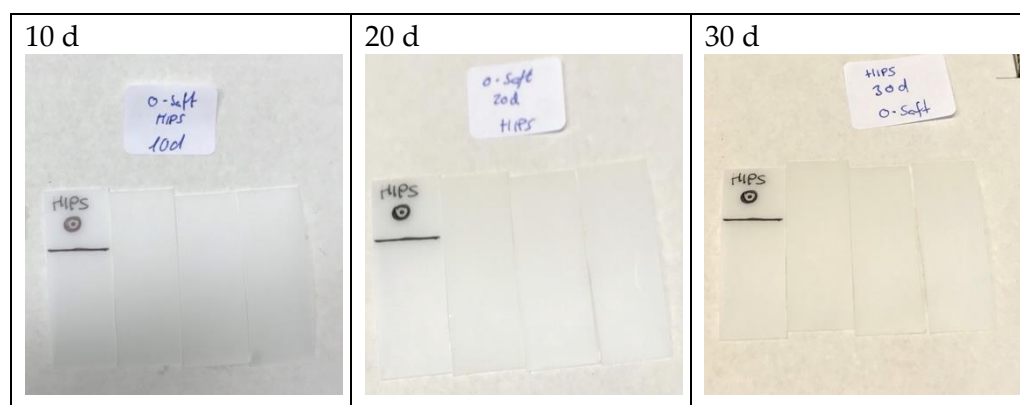


14.6 Miglyol® 812 at 20°C

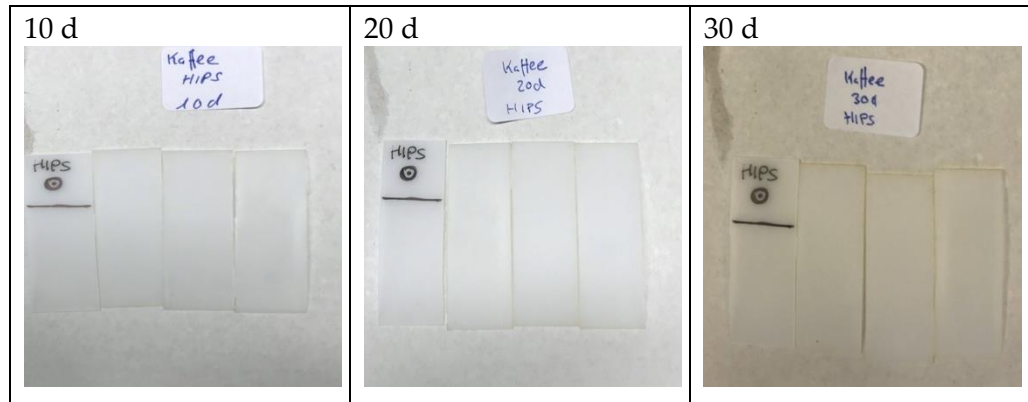


Note: for Miglyol, photos for two replicates (1) and (2) are reported

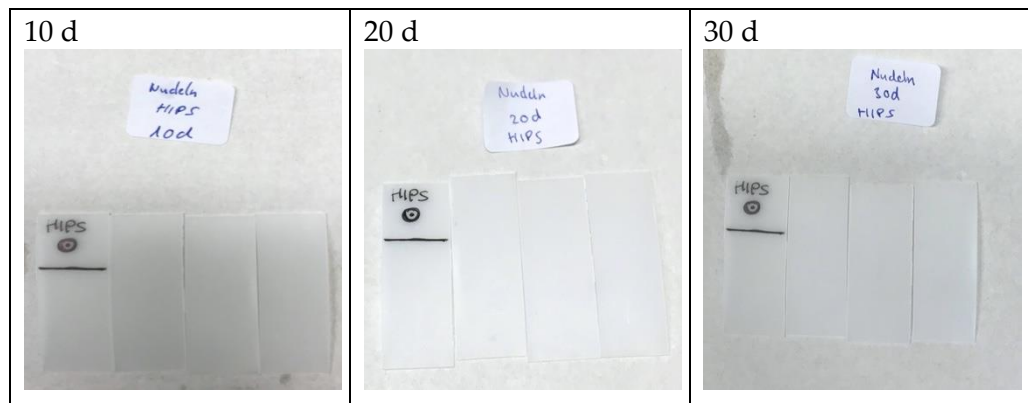
14.7 Clear orange juice at 20 °C



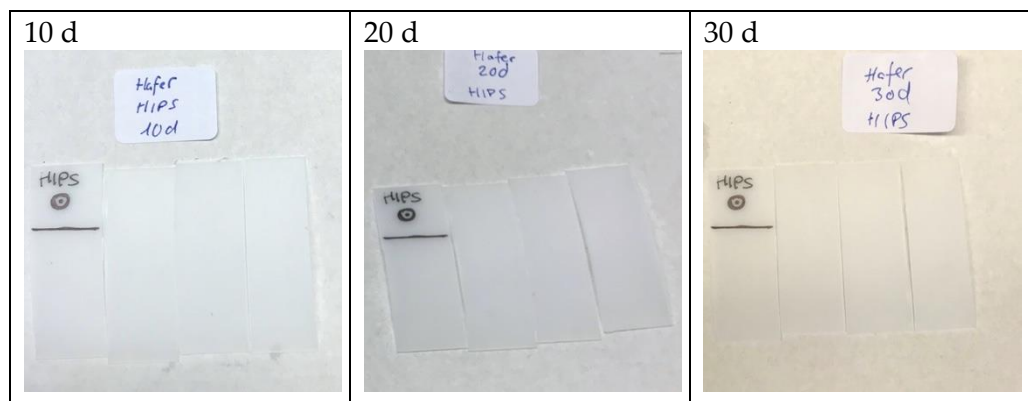
14.8 Ground coffee beans at 20 °C



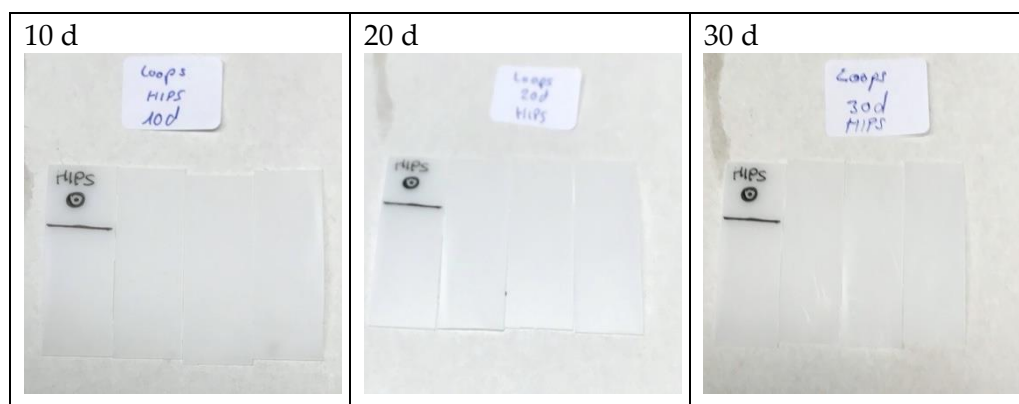
14.9 Noodles at 20 °C



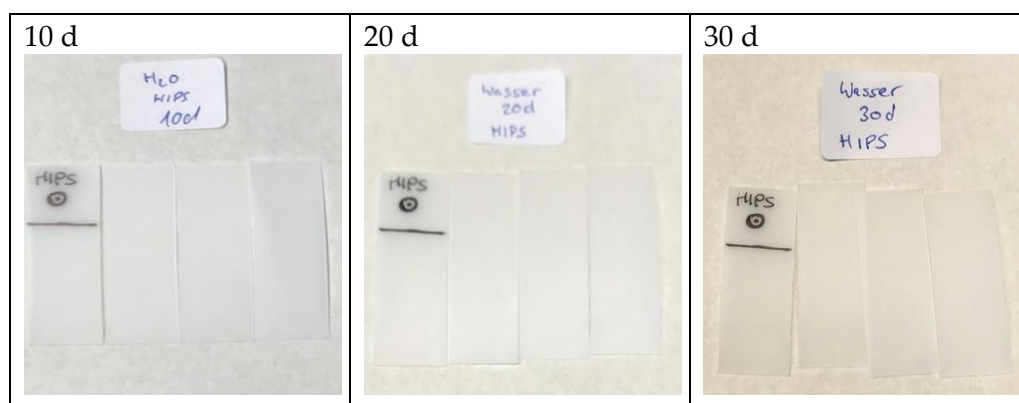
14.10 Oat flakes at 20 °C



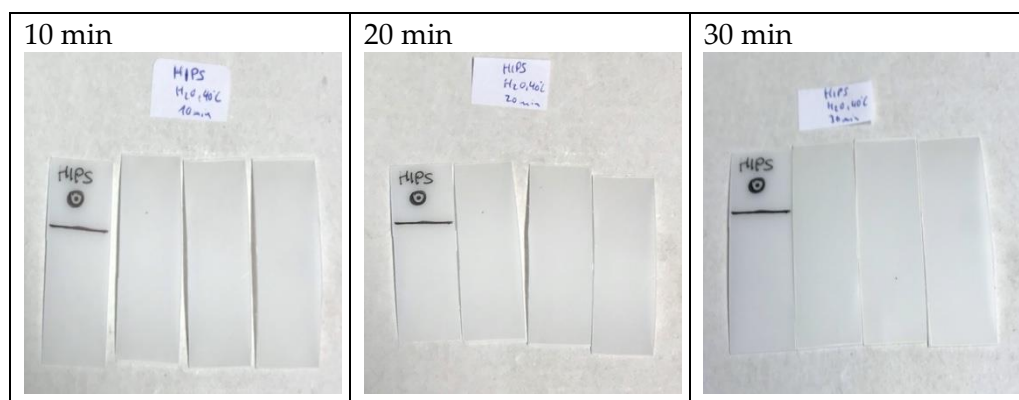
14.11 Wheat loops at 20 °C



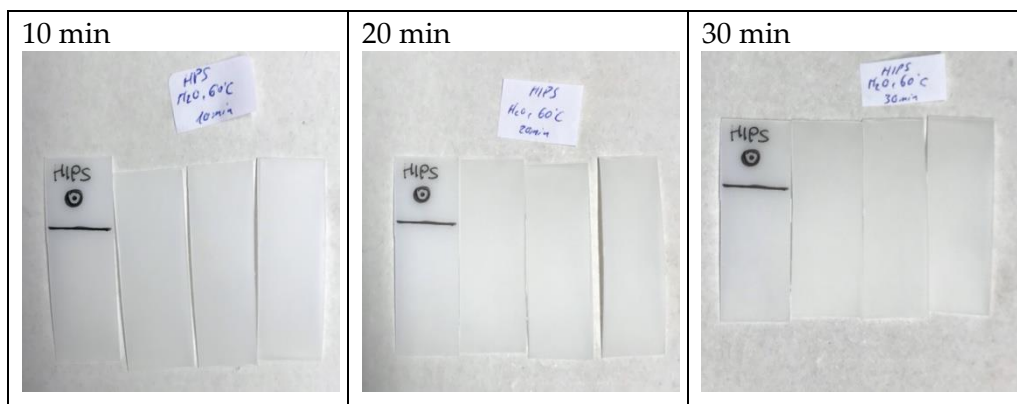
14.12 Water at 20 °C



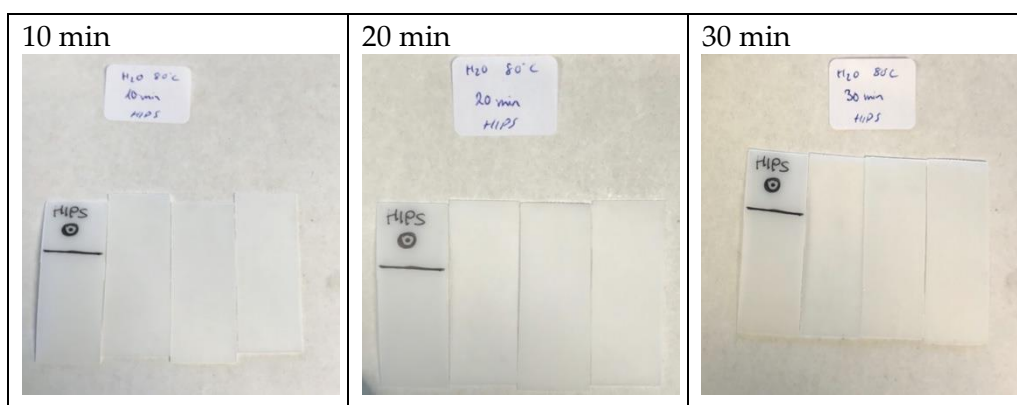
14.13 Water at 40 °C



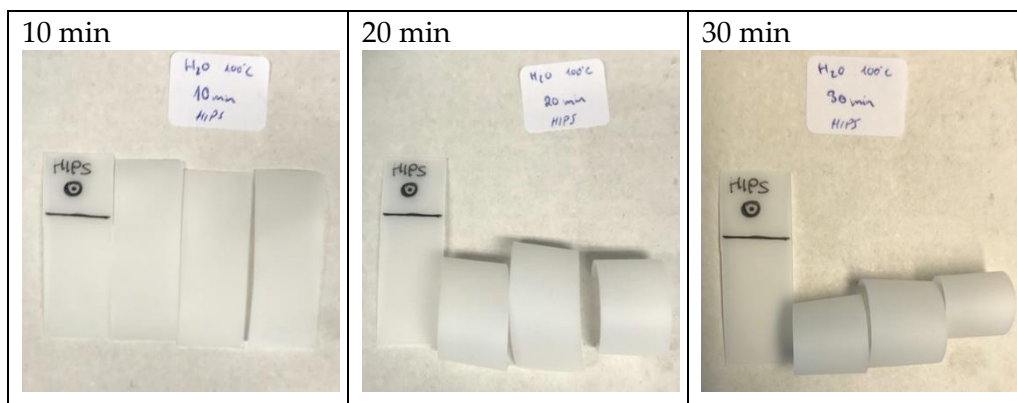
14.14 Water at 60 °C



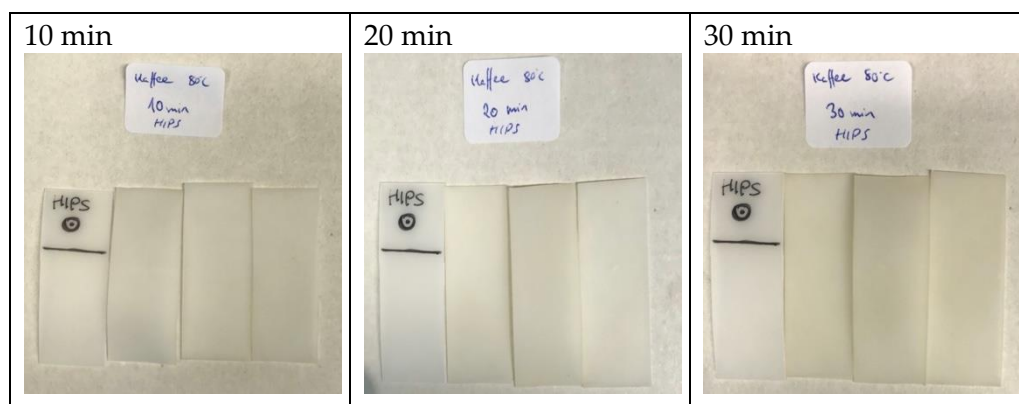
14.15 Water at 80 °C



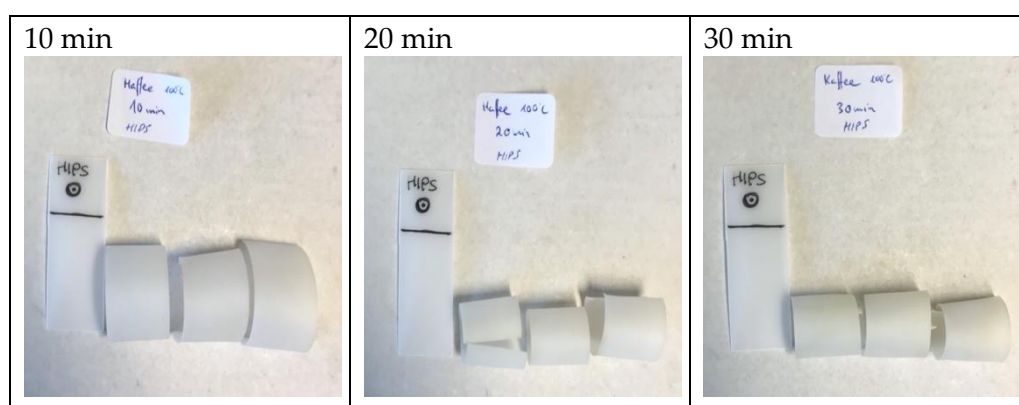
14.16 Water at 100 °C



14.17 Brewed coffee at 80 °C



14.18 Brewed coffee at 100 °C (T_{gradient})



14.19 Brewed coffee at 100 °C (T_{constant})

