Production of biogas from fruit waste

1. Fermentation

1.1 Fill 90 per cent of the fermenter with the inoculum and watch out that it's **gas-proof** when it's closed. The inoculum consists of fruit waste with living microorganisms.

1.2 Parameter of fermentation:

Temperature	37°C
Rotation speed	200 turns per minute

1.3 Add glucose so that the concentration at the beginning of the fermentation amounts 10 g/l.

Task 1:
Measure the concentration of the glucose every 30 minutes.

2. Quantitative determination of biogas

2.1 Link the "Kolbenprober" (you can see it in the picture below) gas-proof to the fermenter. Check the gas-tightness of the fermenter by pulling the "Kolben".

Task 2:
Measure the produced gas / volume at the "Kolbenprober" every 30 minutes and represent the production rate in a graph.

3. Qualitative Determintation of Biogas

3.1 Quick test of inflammableness

Task 3:
Test the ability to burn of the produced gas by using a syringe to put it into a flame.

3.2 Chemical reaktion of CO_2 with "Natronkalk" (= a mixture from NAOH and $Ca(OH)_2$)

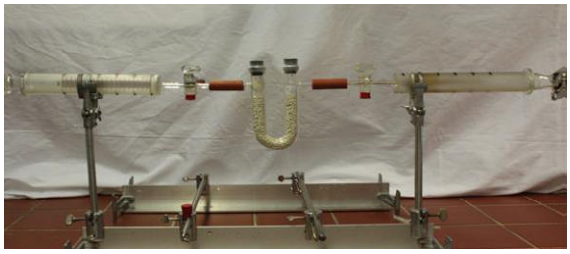

image: equipment to clean up the biogas. The U-pipe is filled with "Natronkalk".

Task 4: Fill 100 ml of the biogas slowly through the U-pipe 3 to 5 times until the volume stays constant. Now infer the amount of the chemical bound CO_2 from the scale of the "Kolbenprober".

Task 5: Complete the following reaction equation:

$NaOH + CO_2 \rightarrow$

$Ca(OH)_2 + CO_2 \rightarrow$

3.3 Gas chromatography

Task 6: Inject 0.5 ml of the produced biogas mixture in the gas chromatograph and analyse the chromatogram.

GC-seperation conditions
mobile phase: Helium
stationary phase: Silicon oil (non polar).

Task 7: Match the retention times of the gases (CH_4, N_2, CO_2) with the peaks of the chromatogram regarding to the substance properties.