



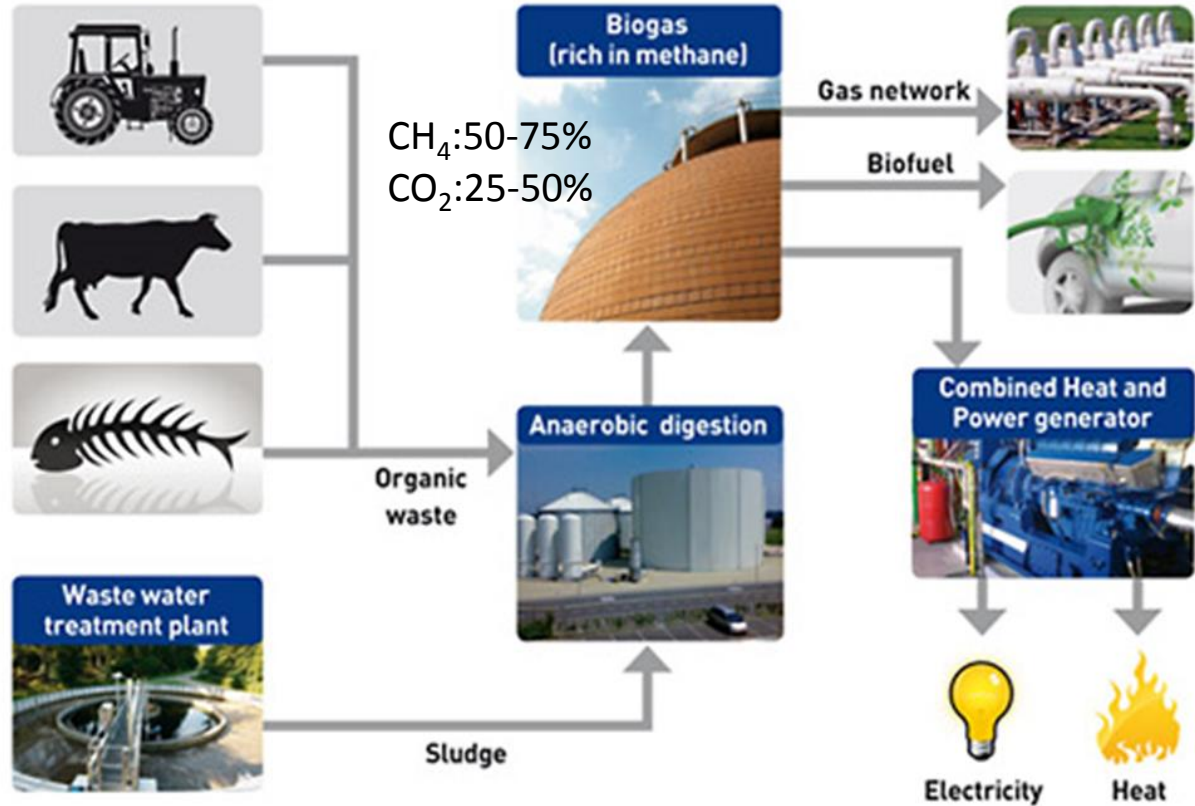
# Novel technologies for integrated biogas separation and compression

Jingxiao Liang(QUB)



Funded by  
the European Union

# Why separate CO<sub>2</sub> from biogas?



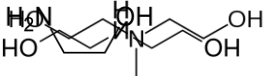
In 2013, Over 14500  
Biogas plants  
7857 MW  
(13.4 million tonnes  
oil equivalent)

282 upgrading plants  
Biomethane  
1.303 billion m<sup>3</sup>

Source: European  
Biogas Association

# Separating technologies in industry

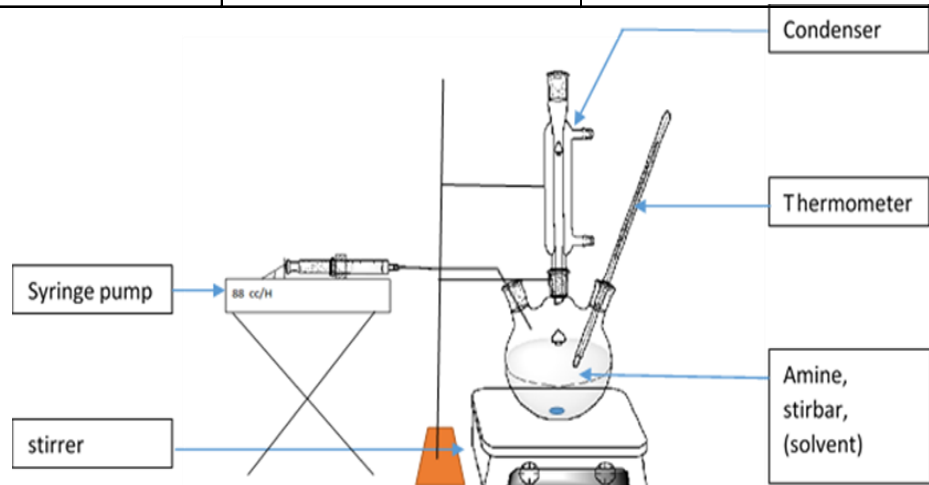
Parameter	Water scrubbing	Organic physical scrubbing	Amine scrubbing	PSA	Membrane
typical <b>methane</b> content in biomethane [vol%]	95,0-99,0	95,0-99,0	>99,0	95,0-99,0	95,0-99,0
<b>methane</b> recovery [%]	98,0	96,0	99,96	98	80-99,5
<b>methane</b> slip [%]	2,0	4,0	0,04	2,0	20-0,5
electric energy <b>demand</b> [kWhel/m <sup>3</sup> biomethane]	0,46	0,49-0,67	0,27	0,46	0,25-0,43
heating <b>demand</b> and temperature level	-	70-80°C	120-160°C	-	-
consumables <b>demand</b>	antifouling agent, drying agent	organic solvent (non- hazardous)	amine solution (hazardous)	activated carbon (non- hazardous)	
typical investment <b>costs</b> [€/ (m <sup>3</sup> /h) biomethane]					
for 100m <sup>3</sup> /h biomethane	10.100	9.500	9.500	10.400	7.300-7.600
for 250m <sup>3</sup> /h biomethane	5.500	5.000	5.000	5.400	4.700-4.900
for 500m <sup>3</sup> /h biomethane	3.500	3.500	3.500	3.700	3.500-3.700
typical operational <b>costs</b> [ct/m <sup>3</sup> biomethane]					
for 100m <sup>3</sup> /h biomethane	14,0	13,8	14,4	12,8	10,8-15,8
for 250m <sup>3</sup> /h biomethane	10,3	10,2	12,0	10,1	7,7-11,6
for 500m <sup>3</sup> /h biomethane	9,1	9,0	11,2	9,2	6,5-10,1



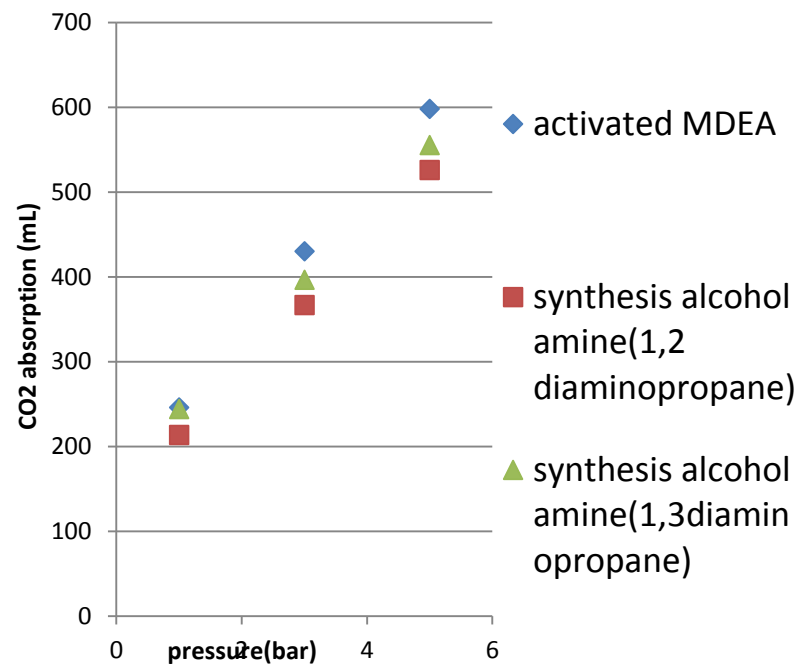
# What I have achieved

## Three traditional alcohol amines

cAlcohol amines	Name	Structure
Primary	Ethanolamine(MEA)	<chem>NCCO</chem>
Secondary	Diethanolamine(DEA)	<chem>NCCOCCO</chem>
Tertiary	Methyl diethanolamine(MDEA)	<chem>CN(CCO)CCO</chem>

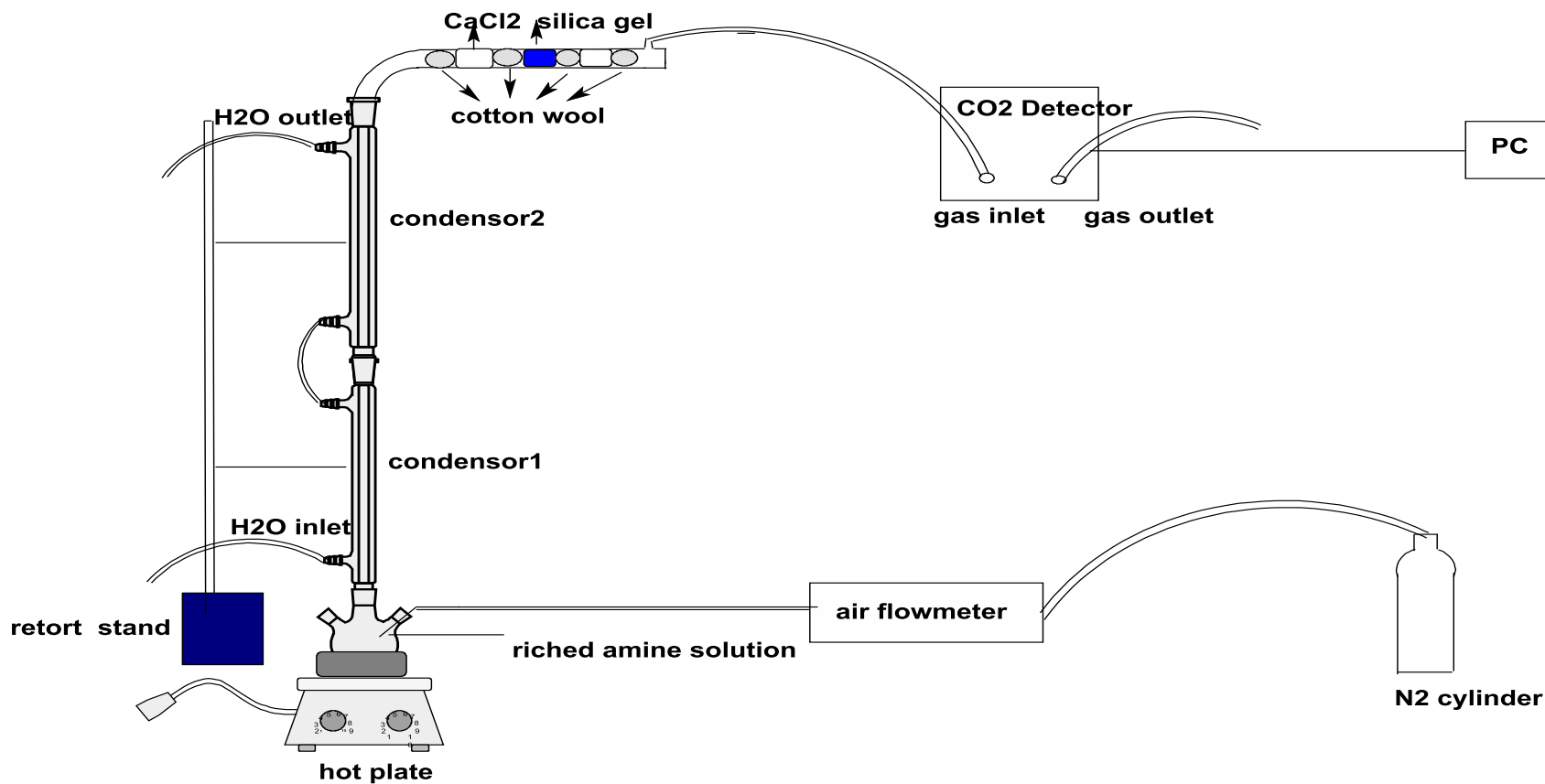


System for synthesise alcohol amines



CO<sub>2</sub> uptake comparison of synthesis alcohol amines with activated methyl diethanolamine(MDEA)

# Experimental setup



## Amine-based CO<sub>2</sub> regeneration setup



## Questions?



*This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement n. 316838*



Project coordinated by the QUESTOR Centre  
at Queen's University Belfast  
[www.qub.ac.uk/questor](http://www.qub.ac.uk/questor)