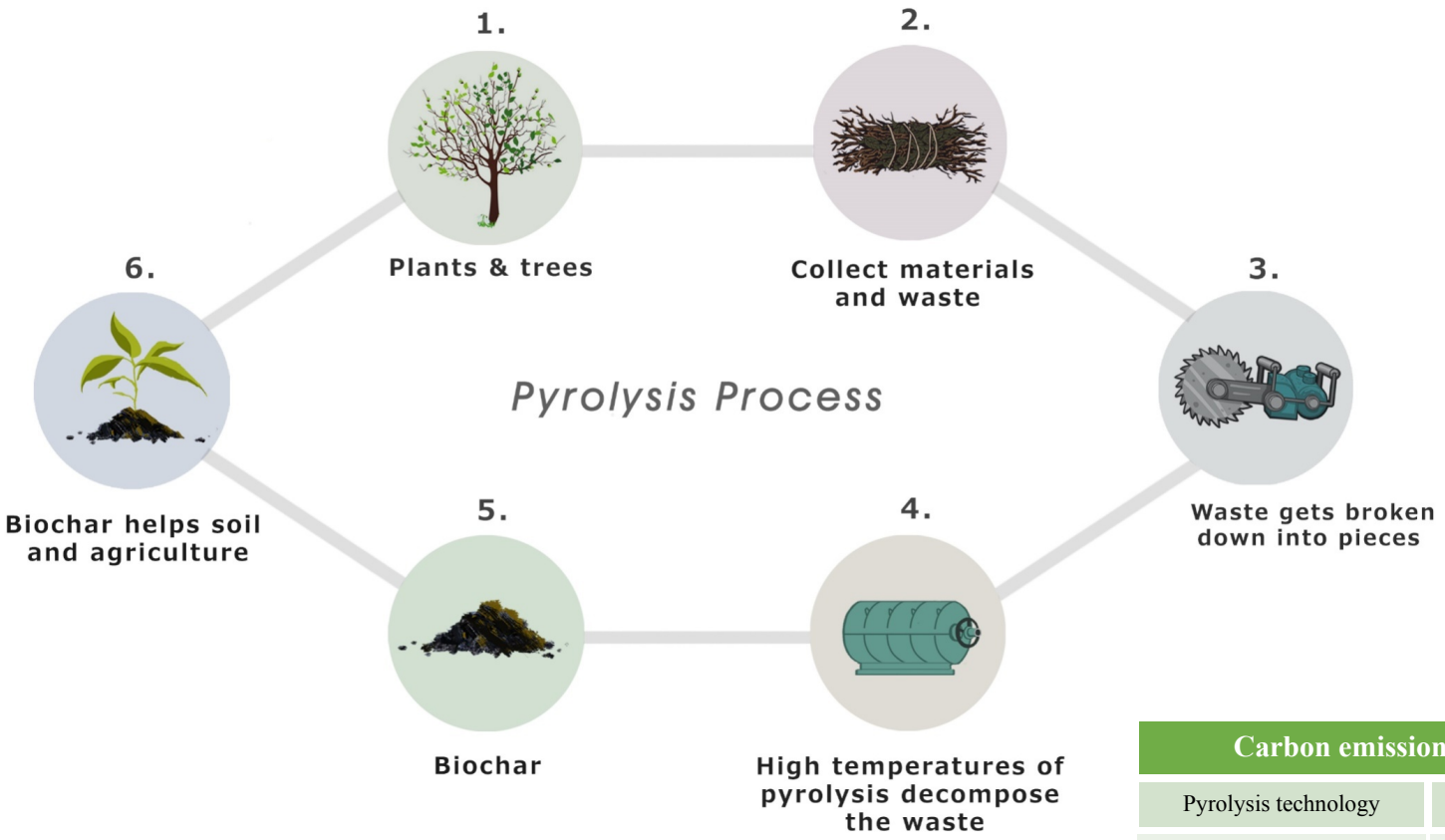
Introduction of almond shell by low temperature pyrolysis treatment project

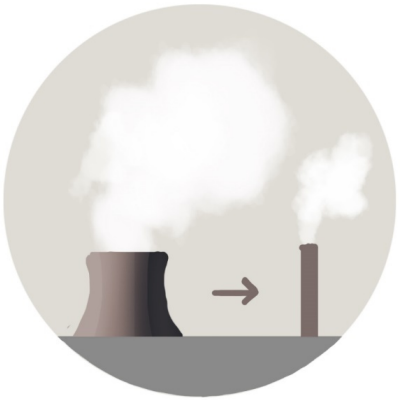
Shanghai Kimkey Environmental S&T Co., Ltd.

Technical Advantages



Carbon emission comparison	
Pyrolysis technology	Traditional technology
Reduce carbon emissions. Convert carbon from raw materials to biomass carbon and use in farmland.	Convert carbon into carbon dioxide and emit it into the air.

The Good Environmental Effect



Low flue
gas emission

No dioxin
or fly ash

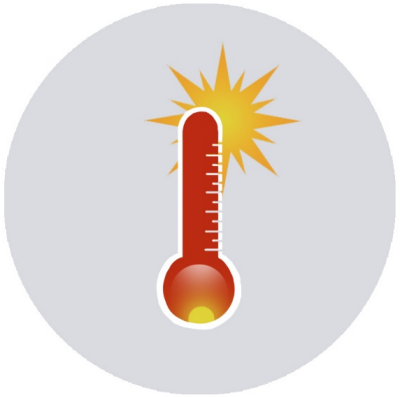
No secondary
pollution

Significant Effect of Carbon Reduction

In the pyrolysis reaction, the majority of carbon atoms in organic matter are kept in the form of solid carbon. As a result, there are no carbon dioxide in the air.

High Resource Utilization Rate

More than
90% of
resources utilized



More than
70% of
heat utilized

Significant
reduction
of waste

Chapter 1

Technology and Background

1.1 Low temperature pyrolysis technology background

- Pyrolysis technology is a new technology to deal with solid waste in recent year. In the early 1990s, foreign scientists found that dioxin which harm people's health will be produced in waste incineration process. therefore, the western developed countries study the secondary pollution come from incineration. At the same time, they invested heavily to develop new technology to deal with solid waste. Pyrolysis technology is considered to be a new way to Reduce harmless waste, minimization and Maximize reuse of resources .



1.2 Pyrolysis technology principle

- Pyrolysis principle
- The pyrolysis process is using the thermo-lability of organic solid waste to decompose organic polymer materials into small molecules in anaerobic or anoxic conditions. and the product is a high quality combustible pyrolysis gas, tar and carbon residue.
  - ➢ Reaction equation:

$$\text{Organic matter} + \text{heat} \xrightarrow{\text{adiabatic or hypoxia}} \text{Gas} + \text{liquid} + \text{solid}$$

  - ➢ pyrolysis product
    - Gas product：CH4、C2H6、H2、CO；
    - Liquid product：CH3OH、CH3COCH3、C2H5COOH、CH3CHO and tar、solvent oil etc；
    - Solid product：carbon residue.

1.3 Pyrolysis technology feature

Pyrolysis Technology Advantage	Incineration Process Disadvantage
No oxygen, indirect heating, the material does not make combustion reaction	Need oxygen to make the material completely burn
Endothermic reaction	Exothermic reaction
The vast majority of carbon in the material has been preserved in solid carbon form, reducing carbon emissions	Carbon in the material will become carbon dioxide into the air after the combustion reaction
Flue gas recycling, less external emissions, no fly ash	Producing a lot of flue gas and fly ash, handling difficult, serious environmental problems
It is an oxygen-free environment, no necessary conditions of producing dioxins	Easy to produce dioxin, high processing costs
Heavy metals in the material are mostly cured in carbon, needn't secondary treating	Heavy metal enrichment in fly ash, need to do curing treatment, high processing costs
Due to the low reaction temperature, there are only a little NOx	High incineration temperature, easy to produce large amount of NOx, high cost of exhaust gas treatment
The reaction environment is a reduction reaction, so Cr3 + does not oxidize to Cr6 + highly toxic	Cr3 + will oxidize to Cr6 + highly toxic substances, increase environmental hazards
Recycling combustible gas, fuel oil and carbon to sale	Only can recycle hot steam to generate electricity

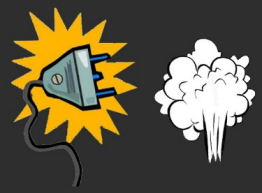
1.4 Pyrolysis technology feature

Good Pyrolysis Technology	vs	Bad Incineration Process
No oxygen Indirect heating The material does not create combustion reaction		Need oxygen in order for the material to completely burn
Endothermic reaction		Exothermic reaction
The vast majority of carbon in the material has been preserved in solid carbon form, reducing carbon emissions		Carbon in the material will become carbon dioxide into the air after the combustion reaction.

1.5 Pyrolysis technology feature

Good Pyrolysis Technology	vs	Bad Incineration Process
Flue gas recycling Less external emissions No fly ash		Produces a lot of flue gas and fly ash Difficult to handle Serious environmental problems
Oxygen free environment No necessary conditions of producing dioxins		Easy to produce dioxin High processing costs
Heavy metals in the material are mostly cured in carbon and does not need secondary treating		Carbon in the material will become carbon dioxide into the air after the combustion reaction.

1.6 Pyrolysis technology feature

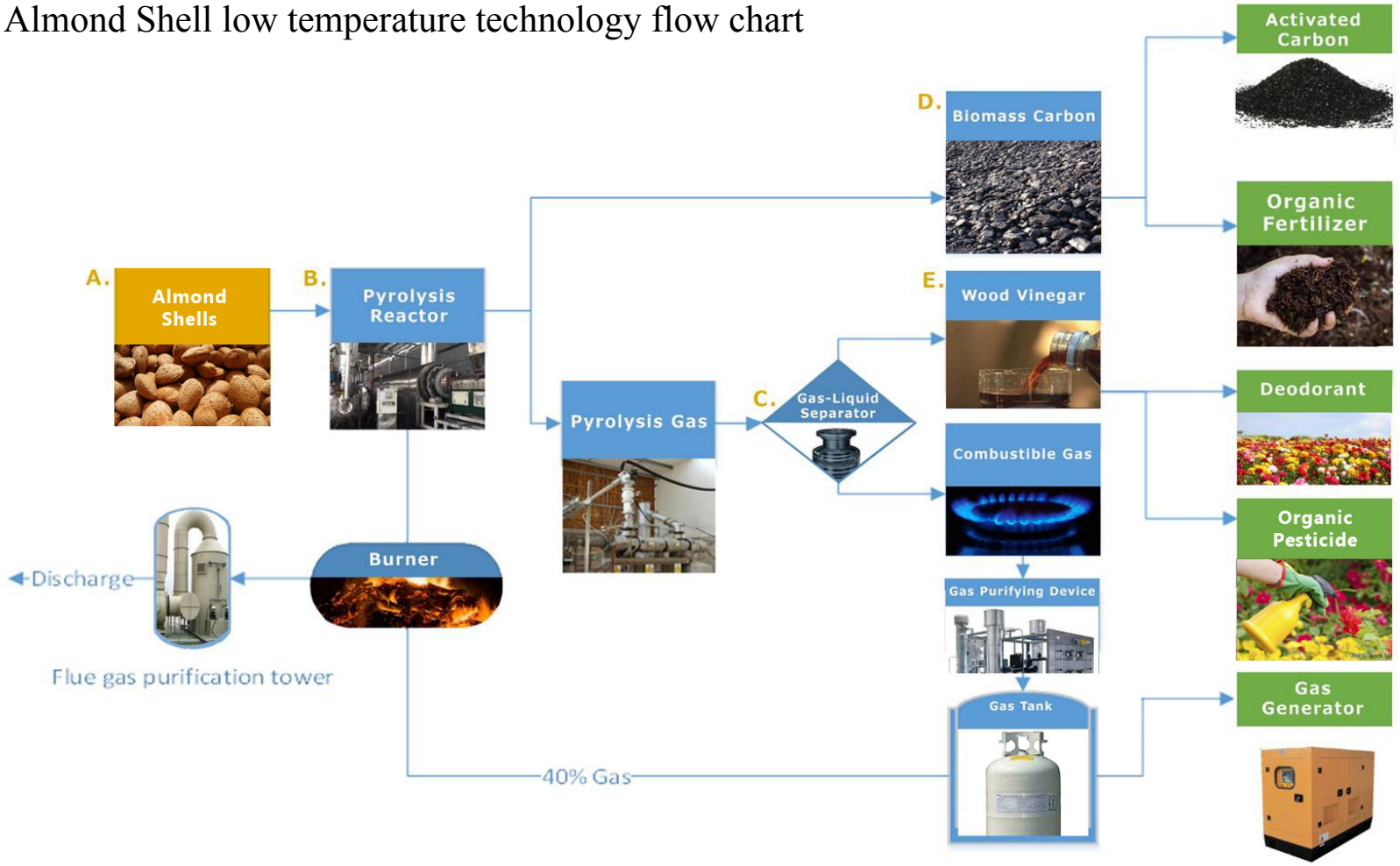
Good Pyrolysis Technology	vs	Bad Incineration Process
Due to the low reaction temperature, there are only a little NOx		High incineration temperature Easy to produce a lot of NOx High cost of exhaust gas treatment
The reaction environment is a reduction reaction Cr3 + does not oxidize to Cr6 + highly toxic		Cr3 + will oxidize to Cr6 + highly toxic substances Environmental hazards will increase
Recycling combustible gas, fuel oil, and carbon to sale		Recycling hot steam is its only way of generating electricity

Chapter 2

The introduction of almond shell low temperature pyrolysis project

2.1 Technology Flow Chart

Almond Shell low temperature technology flow chart



2.2 Process Description

- A、The almond shell is crushed and sent to the pyrolysis reactor by the conveyor
- B、The pyrolysis reaction temperature of the almond shell is generally between 450 and 550 ℃. Through the wall heat transfer, the heat of high temperature flue gas transfer to the almond shell in the reactor. Then almond shell absorbs heat and occurs pyrolysis reactions.
- C、The high temperature oil and gas and biomass carbon formed after the pyrolysis reaction are fed into the condensing system and the biomass carbon discharging system through the discharging device.
- D、The biomass carbon is cooled during the discharge process and is fed into the biomass carbon storage tank through negative pressure air.
- E、High temperature oil and gas get into the condensing system to form non-condensable gas (mainly combustible gas) and liquid wood vinegar. wood vinegar store into tank and can be sold as product. combustible gas store into gas tank, a part of combustible gas is used as system energy to provide the heat, the rest can be used for power generation through combustion engine

2.3 Material balance

- Product yield：

According to the different almond shell type, the product yield was slightly different.

Generally in the following range:

Product	Rate
Biomass carbon	33%
Wood vinegar	17%
Combustible gas	50%

- Biomass carbon besides can be used as a fuel, it is also a good soil modifier and organic carbon fertilizer. Biomass carbon has a good effect on water retention, slow release;
- Wood vinegar is widely used in agriculture, it can be used as plant growth promoting agent, soil conditioner, deodorant, feed additive, organic fertilizer and so on;
- Combustible gas: The 40% of combustible gas can be used to provide energy for the systems, the remaining 60% can be used for power generation.

Chapter 3

Market prospect of wood vinegar and biomass carbon

3.1 The application of wood vinegar

In agriculture and forestry industry	• promote plant growth • sterilization • disease prevention • pest control and soil improvement
In beasts and birds industry	• Used as a feed additive and deodorant
In other industry	• be used to prepare environment-friendly snow-melting agent • be processed into daily chemicals, health products • apply in beauty care, medicine and health and food processing

4.2.1 Definition of biomass carbon

At the first international bio-carbon base fertilizer conference held in Australia in 2007, the bio-carbon base fertilizer was defined as follows:

"Biomass charcoal, also known as bio-carbon base, biomass coke. It is a carbon-rich product that is produced by pyrolysis of biomass (wood, branches and leaves, crop wood chips, livestock manure, etc.) in anaerobic and hypoxic confined environment, temperature <700 ℃ conditions."

4.2.2 The main uses of biomass carbon

- Biomass carbon can repair contaminated soil.
- Biomass carbon has the effect of water absorption and water retention on soil.
- Biomass carbon can improve soil fertility and fertilizer utilization.
- Biomass carbon has a carbon sequenstration effect.

Chapter 5

Company profile

5.1 Company profile

- Shanghai Kimkey Environmental S&T Co., Ltd was established in 2008 with registered capital of 55 million yuan and is located in Shanghai Zhangjiang HI-tech Park. Kimkey is a high-tech enterprises and it complete joint-stock system in April 2011 and listed on Shanghai Equity Exchange in September 2013, stock code is 100095.
- Shanghai Kimkey Environmental S&T Co., Ltd. Company is engaged in the development and application of polymer solid organic waste pyrolysis technology， and Set research and development, integration, sales, installation / training and after-sales service in one.
- Kimkey has deep cooperation with domestic colleges and universities and build production, education and research platform. In addition, successively started production, education and research contracts with Tongji University, Zhejiang University, East China University of Science and Technology, Xi'an University of Science and Technology, Kunming University.

5.1 Company profile

- The first industrial integrated control of waste rubber low-temperature pyrolysis equipment developed by Kimkey passed technical appraisal of Ministry of Industry in 2012. And on this basis, Kimkey finished the first domestic waste comprehensive treatment low-temperature pyrolysis after 3 years. with the thorough research of pyrolysis industry, Kimkey has accumulated a lot of experience in pyrolysis technology and has gradually extended to waste plastic, straw and sludge area.

- Kimkey has developed multiple area pyrolysis Equipment successfully including waste rubber, waste plastics, household waste, straw and sludge, etc.

5.2 Indigenous innovation

Independent research & development

- Waste tires low temperature pyrolysis equipment
- Domestic waste pyrolysis equipment
- Waste plastics pyrolysis equipment
- Straw pyrolysis equipment
- Oily sludge & sludge pyrolysis equipment

Intellectual Property

- 8 patents
- 43 utility model patents
- 1 design patent
- 4 PET

Thank you