

PETROLEUM
THERMAL CONVERSION
PROCESSES

CONTENTS

1-INTRODUCTION

2-THERMAL CRACKING REACTION

3-THERMAL CRACKING PROCESS

4-VISBREAKING

5-CONVENTIONAL VISBREAKING

6-SOAKER VISBREAKING

INTRODUCTION

- *The process in which hydrocarbons are decomposed at elevated temperature to form material of lower molecular weight are called thermal conversion processes.*
- $\text{C-C-C-C-C-C-C} \longrightarrow \text{C-C-C} + \text{C-C-C-C}$
- (Heptanes) (Propane) (Butane)
- *The first continuous thermal cracking process were obtained by Jesse Dubbs in 1913.*

History

Old process,

- 1- Single coil unit.
- 2- Reaction chamber.
- 3- Dephlegmator.
- 4- Run length= 120days.
- 5-Feed ratio very high.

New process,

- 1- Two coil unit.
- 2- Large reaction chamber.
- 3- Dephlegmator.
- 4- Hot oil pump.
- 5- Run length= 210days.
- 6- Feed ratio low.

Thermal cracking reaction

- *Decomposition of the long chain oil molecules into shorter chains through free radical.*
- $C_8H_{18} \xrightarrow{\text{heat}} C_6H_{13}^\bullet + C_2H_5^\bullet$
- $C_2H_5^\bullet + C_8H_{18} \longrightarrow C_2H_6 + C_8H_{17}^\bullet$
- $C_8H_{17}^\bullet \longrightarrow C_8H_{16} + H^\bullet$
- $C_6H_{13}^\bullet + H^\bullet \longrightarrow C_6H_{14}$
- *Cracking reactivity decreases as side chain is increase, unsaturated, cycle or aromatic ring is present.*

THERMAL CRACKING

- Cracking reaction begin to occur at temperature of about 315-370° C.
- Thermal cracking conversion increases with temperature and residence time.
- Pressure determine the phase in which cracking reaction take place.
- Under severe cracking condition there is tendency for coke formation.

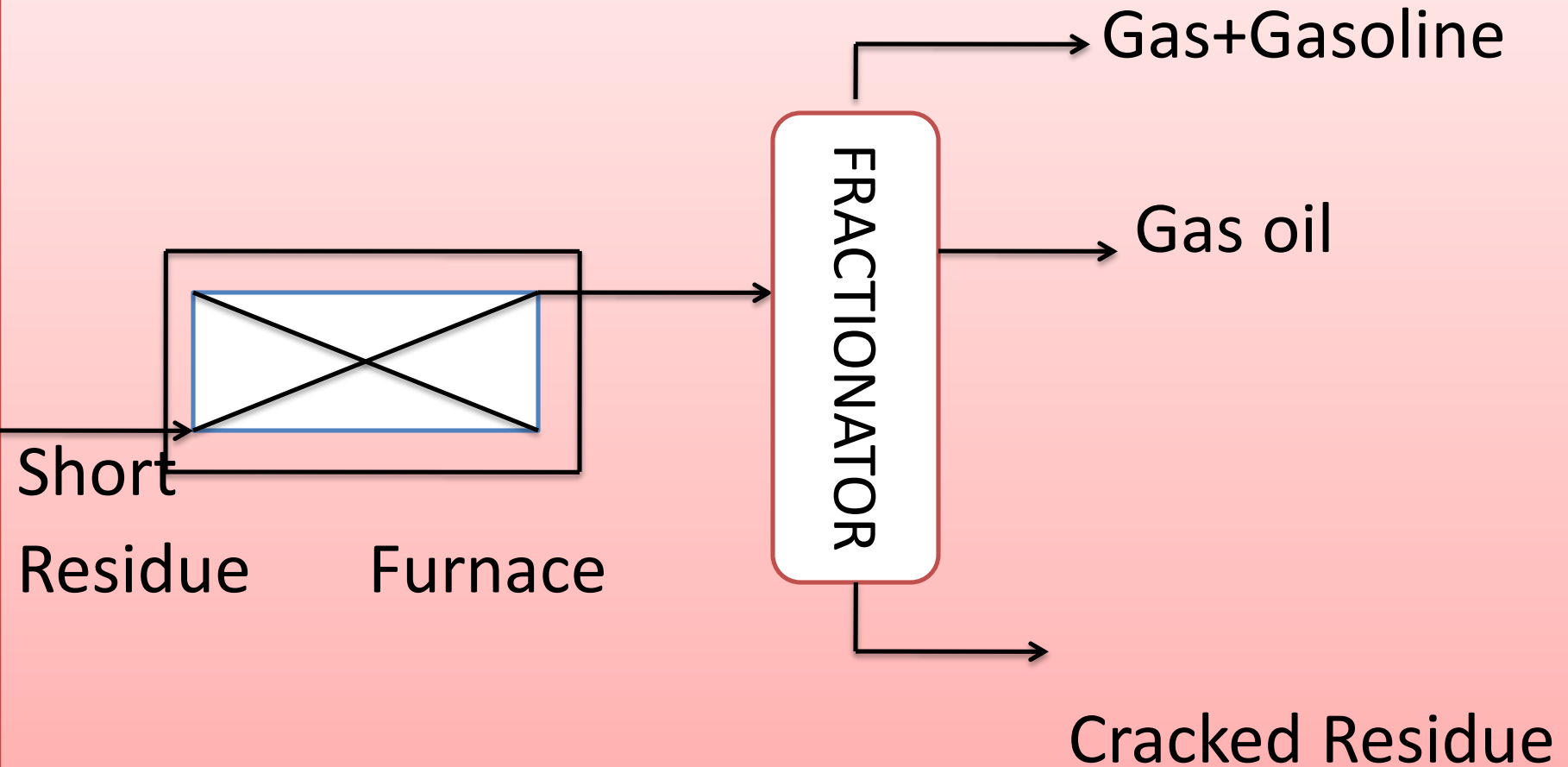
THERMAL CRACKING

- This was earliest method used by refiners to get light distillates from crude oils.
- The product of thermal cracking have very poor stability and need further treatment.
- This process produce gas, naphtha, middle distillate and thermal tar from every charge stocks.
- The gas produce are propylene and butylenes.

NEW PROCESS

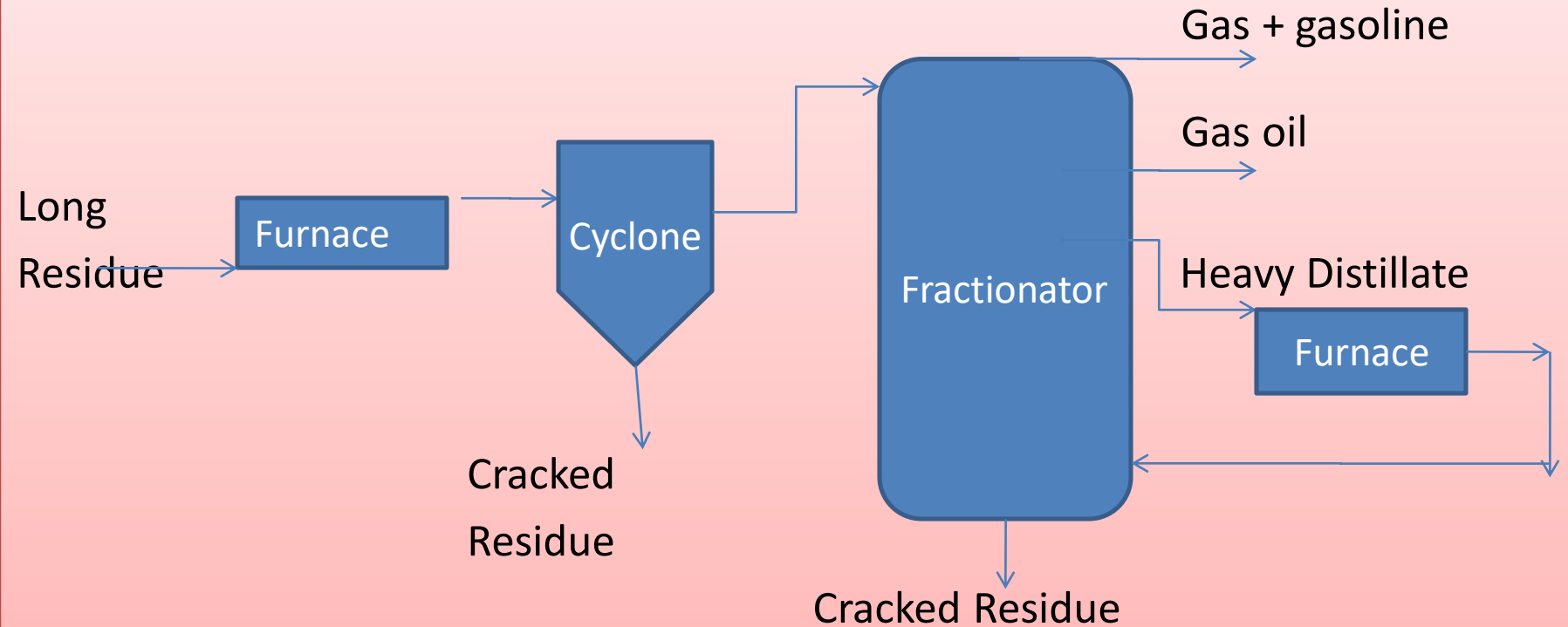
- At present Fluid Catalytic Cracking(FCC) find more favour than Thermal Cracking.
- The latest cracking process is DCC (Deep Catalytic Cracking) which is used by IOCL and INDMAX.
- In DCC selective cracking of feed is done to maximize the light products.

Flow sheet



Thermal cracking process

Flow sheet



Thanks