計畫成果中英文摘要（簡要版）

一、中文計畫名稱：

污泥類廢棄物轉換能源技術之實廠應用可行性評估

二、英文計畫名稱：

Feasibility of application for energy from sludge in full-scale plant

三、計畫編號：EPA-101-U1U4-04-004

四、執行單位：逢甲大學/台灣潔淨能源科技股份有限公司

五、計畫主持人（包括協同主持人）：江康鈺、葛家賢、童翔新、吳志超

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十三、中文摘要關鍵詞：

下水污泥、漿紙污泥、氣化、加速碳酸鹽反應

十四、英文摘要關鍵詞：

sewage sludge; paper-mill sludge; gasification; accelerated carbonation

十五、中文摘要（約三百至五百字）

本研究目的在於探討漿紙及都市下水污泥能源轉換技術之實廠可行性應用評估，研究同時擬開發兼具減碳效益之殘餘物再利用關鍵技術，以進一步達到能源轉換過程之二氧化碳減量及殘餘物回收再利用之目的。研究結果顯示，漿紙污泥摻混比例較高時，因其固定碳含量增加，其熱反應活性相對降低，然當摻混下水污泥時，能有效降低漿紙污泥反應所需之活化能。實廠氣化處理之驗證結果顯示，不同摻混比例之漿紙與下水污泥氣化反應生成之合成氣，H_2 及 CO 組成比例分別約佔 2%~4%及 3%~7%，CH_4 及其他碳氫化合物等可燃性氣體，則約佔產氣組成之 2%~5%。氣化產氣之熱值，約介於 4 MJ/Nm^3~8 MJ/Nm^3 之間，能源密度約介於 0.8~2.0。以含水率約 67%之 2 噸濕混合污泥而言，經乾燥後可產生 1 噸之乾污泥(含水率約 30%)，經氣化處理後可產生 6.15 噸之合成氣，經鍋爐及熱交換後，每小時可回收 1.34 噸之蒸汽熱能，並提供廠內之乾燥器使用，

達到能源自給自足之目的。漿紙污泥經氣化反應後之底渣，因其富含鈣化合物，經利用加速碳酸鹽化反應操作後，初步推估當氣化底渣與 5%~15%之二氧化碳反應 8 小時，每 100 克之氣化底渣約可捕捉 15~18 克之二氧化碳，經前述加速碳酸鹽反應後之氣化底渣，因其富含碳酸鈣成分，後續可進一步開發為建築資材之材料應用。

十六、英文摘要：

This study investigates the feasibility of the application of energy from paper-mills and sewage sludge in full-scale plants. The key technology for reducing carbon dioxide and recycling residue from energy conversion were also developed and discussed. The experimental results indicated that thermal reactivity was relatively decreased due to the paper-mill sludge containing higher fixed carbon content. To increase the thermal reactivity and/or decrease the activation energy of paper-mill sludge in thermal conversion, the sewage sludge addition could enhance the efficiency of thermal reactivity. The results of performance tests in the full-scale plant demonstrated that the hydrogen (H_2) and carbon monoxide (CO) contents in synthesis gas were approximately 2%-4% and 3%-7%, respectively. Methane (CH_4) and other combustible gases, such as C_2H_2, C_2H_4, C_2H_6, other hydrocarbon gases, also ranged between 2% and 5%. The heating value and energy density of produced gas ranged from 4 MJ/Nm^3 to 8 MJ/Nm^3 and ranged from 0.8 to 2, respectively. Based on the results of performance tests in the full-scale plant, one ton of tested and dry sludge (based on 30% moisture content) was produced from two tons of wet sludge (based on 67% moisture content) by the drying process. This dry sludge can produce approximately 6.15 tons of synthesis gases by gasification. The synthesis gases were introduced into combustor and converted them into heat. Overall, this process recovered 1.34 tons per hour of steam to provide the energy requirement of the on-site dryer. The experimental results indicated that the 100 grams of tested residues could capture approximately 15-18 grams of carbon dioxide as the reaction time for carbonation was 8 hours, and 5%-15% carbon dioxide was supplied. This is because the residues produced from gasification of paper-mill sludge containing higher calcium content it can act as a reactant to capture the carbon dioxide during the accelerated carbonation process. Further studies also need to develop resourcification technologies for manufacturing the building materials from residues after the accelerated carbonation process.