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• 中文關鍵字	三鹵甲烷; 鹵乙酸類; 溴酸鹽; 醛類; 藍綠藻數; 微囊藻毒素; 綜合性功能評估
• 英文關鍵字	THMs; HAAs; Bromate; Aldehyde; Cyanobacteria; Microcystin; Comphensive performance evaluation
• 中文摘要	目前台灣已正式營運之第一座高級淨水場「澄清湖淨水場」，此淨水場在一般傳統處理程序外增加了前、後臭氧(pre- and post-ozonation)與生物活性碳(BAC)等處理單元，有效地提升大高雄地區之飲用水水質並減少致癌性加氯消毒副產物，三鹵甲烷(THMs)與鹵乙酸類(HAAs)的生成。但是，澄清湖淨水場之高級處理程序中增加了臭氧消毒消毒副產物的生成。如：溴酸鹽(Bromate)和醛類(Aldehyde)等物質。因此，本研究除三鹵甲烷外，亦擬將研究範圍擴展到國內清水常見之鹵化乙酸、以及臭氧淨水程序所生成之溴酸鹽、醛類等，以了解消毒副產物對民眾飲水之暴露影響。由澄清湖淨水場原水資料進行相關性分析發現，濁度與鐵、錳與生物可利用有機碳間呈現高度正相關。因此當原水濁度提升時，需同時監測鐵、錳與生物可利用有機碳等濃度，以確保水源的安全。在生物指標方面，藍綠藻與葉綠素的數量呈現正相關，由分析資料中顯示，藍綠細菌藻種可能爲適合高濁度生長環境，反之微囊藻則不適合生長。在消毒副產物分析中發現 TCM、DCBM 與 DBCM 之莫耳濃度相當接近，可判斷若水庫中溴離子含量過高，三鹵甲烷以含溴物種形式存在時，較易超出法規標準(80μL)。因此，建議飲用水水質標準中應訂定個別消毒副產物之物種標準。澄清湖淨水廠 Bromine Incorporation Factor(BIF)值約維持在 1.5，但有逐漸升高的趨勢，因此澄清湖淨水廠溴離子污染情形需格外關注。因爲澄清湖淨水廠是採用前後臭氧之處理方式。因此，生成較高濃度溴酸鹽與高 Percentof Bromine Incorporation(PBI)值。在各單元消毒副產物生成潛勢的實驗中發現，淨水場各單元之耗氯量逐漸下降且去除消毒副產物前質之效果良好。其中以預前臭氧處理單元的效果最顯著(約 25 %去除率)。在後臭氧反應槽時，較高之臭氧濃度較易生成溴酸鹽，與醛類。其中，醛類經 BAC 處理單元後，因生物作用分解醛類中的甲醛，降低醛類濃度，

提升飲用水水質之安全。在消毒副產物生成流佈研究中結果顯示，以總有機碳作爲替代指標進行各處理單元之消毒副產物之流佈研究效果最佳。此外，本研究由澄清湖原水及添加物等實驗，建立溴酸鹽與三鹵甲烷的生成預測模式。本研究進行淨水場綜合性功能評估(comphensive performance evaluation, CPE)後，由評估結果顯示，快混池與膠凝池屬於第一類型，表示現有操作容量不會造成處理功能上之問題；快濾池與清水池屬於第二類型，可藉由操作、管理和維護上之技術支援，達淨水場操作最佳化。因此，快混池可由改善過濾速度，提高率定處理量；清水池可由改善擋板，增加清水池的有效體積提高率定處理量，達淨水場操作最佳化。

- 英文摘要

The Cheng-Chin Lake water treatment plant is the first operated advanced water treatment plant in Taiwan. Except for conventional treatment processes, the utilization of pre-, post-ozonation and biological activated carbon (BAC) in the treatment plant would improve the drinking water quality and reduce the carcinogenic chlorination by-products formation such as THMs, and HAAs effectively. However, the ozonation by-products are found in the finished water including aldehyde, and bromate formation in the Cheng-Chin Lake water treatment plant. Therefore, in addition to THMs, this investiagtion would further expand the research extent such as the HAAs, aldehyde, and bromate to research the risk of the exposure for the disinfection by-products in the public water supply system. According to the correlation analysis of source water information from the Cheng-Chin Lake, the turbidity exhibits high correlation with iron, manganese, and assimilable organic carbon (AOC). The phenomenon suggests that the increasing turbidity is corresponded to upgrade iron, manganese, and assimilable organic carbon concentration. In the biological items, the amount of cyanobacteria also shows high correlation with chlorophyll a. The cyanobacteria are suitable living in the high turbidity condition, but the microcysis spp. is not. In the analysis of disinfection by-products formation, the mole concentrations of TCM, DCBM, and DBCM in THMs formation are much closed. The phenomenon would indicate that the high bromide concentration would result in the the high containing bromide THM formation, which have higher probability to exceed the regulation (80 μL). Therefore, the regulation should be revised in the individual species of THMs. The value of Bromine Incorporation Factor (BIF) maintained at 1.5. But the BIF value increased in the recent years, which should be more concerned. Because the utilization of pre- and post-ozonation processes, the Percent of Bromine Incorporation (PBI) for bromate is higher in the Cheng-Chin Lake water treatment plant. In the formation potential experiment of disinfection by-products for the different treatment units in the Cheng-Chin Lake water treatment plant, the chlorine consumption deseases gradually and the reduction of organic precursors exhibits the high performance, especially in the pre-ozonation process (almost 25% removal efficiency). In post-ozonation process, the high ozone concentration would form the bromate aldehyde. In the aldehyde formation, the biological reaction could decompose formaldehyde to decrease the aldehyde formation concentration and to improve the water quality in the BAC process. Moreover, the total organic carbon is the best surrogate parameter in the disinfection by-products formation investigation. Moreover, according to the source water and addition experiment, the model of bromate formation and THMd formation proposed in the investigation. The results of the Comphensive Performance Evaluation (CPE) reveal that the rapid-mixed and coagulation tank can be classified as I type, which means that the precent operation

capacity couldn’t influence the treatment performance. The repid filtration and clear well can be classified as II type, which could be achieved the optimizing operation by the comprensive technology assistance (CTA). Therefore, in order to achieve the optimizing operation, the repid filtration could increase the rated capacity by increasing the filtration rate, and the utilization of baffling III would enhance the rated capacity in clear well.