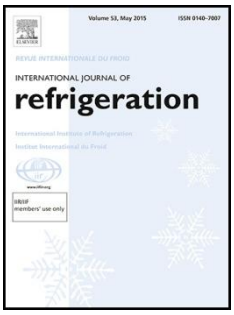

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Investigation on gradient thermal cycle for power and refrigeration cogeneration

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Highlights

- A novel gradient thermal cycle for power and refrigeration cogeneration is proposed.
- ENG-TSA as the additive improves the heat and mass performance of composite adsorbent.
- The maximum power and cooling effect can be obtained as 204 W and 0.91 kW, respectively.
- The exergy efficiency of heat utilization ranges from 18.8% to 24%.

Abstract: In order to improve energy utilization efficiency of low grade heat, a novel gradient thermal cycle for power and refrigeration cogeneration is proposed. The cycle is cascaded with two stages based on different thermal driven temperature. The first stage is pumpless Organic Rankine Cycle (PRC) while the second stage is two-stage sorption refrigerator. R245fa is selected as the working fluid of PRC whereas $CaCl_2$-$BaCl_2$-NH_3 working pair is chosen for two-stage sorption refrigerator. Different heat source temperature from 80^{o}C to 95^{o}C are adopted for analysis and comparison. Results indicate that the highest average power output and cooling effect are able to reach 204 W and 0.91 kW under the condition of 95^{o}C heat source temperature and 10^{o}C refrigeration temperature. For different heat source temperature, total energy and exergy efficiency of the gradient thermal cycle for power and refrigeration cogeneration range from 9.49% to 9.9% and 10.9% to 11.8%, respectively. For gradient thermal cycle exergy efficiency of heat utilization ranges from 24% to 18.8%, which is 126.5% and 70.9% higher than the PRC and two-stage sorption refrigerator, respectively when the heat source temperature is 80^{o}C.