

Zukunft Bau

STRUKTUR / GLIEDERUNG KURZBERICHT

Titel

Optimierung von Abwasserwärmetauschern für den gebäudetechnischen Einsatz

Anlass/ Ausgangslage

kurze Beschreibung des Problems und des Lösungsansatzes
max. 450 Zeichen (mit Leerzeichen)

The central problem in the heat recovery from waste water is the heat transfer, which is reduced by fouling formed in the waste water on the heat exchangers. Fouling in waste water heat exchangers have not been adequately studied so far. Within the framework of this research project, a test bench is being developed, which allows the fouling growth on heat exchangers (copper, PTFE, stainless steel) to be measured with sufficient precision.

Gegenstand des Forschungsvorhabens

Beschreibung der Arbeitsschritte und des Lösungswegs
max. 4.300 Zeichen (mit Leerzeichen)

An effective way to reduce energy consumption in Germany is the more efficient use of energy. This can be achieved via energy recycling or heat recovery systems. The energy requirement of private households for hot water production is approx. 15% of the total energy demand of an average building.

This energy is usually only used for a very short process and then flows mostly unused into the sewage system. Heat recovery systems make it possible to reuse the energy elsewhere.

The central problem in the heat recovery from waste water is the heat transfer, which is reduced by the biofilm formed in the waste water on heat exchangers. Fouling growth has so far not been adequately studied. For wastewater, only insufficient data are available on the heat transfer-reducing of fouling. Without knowledge of the expected heat transfer reduction, the correct design and thus also the efficient operation of decentralized waste water heat recovery systems are significantly more difficult.

Within the scope of this research project, a test bench is being developed, which makes it possible to determine fouling growth on heat exchangers with sufficient accuracy. Reliable data on biofilm development on heat exchangers as well as the amount of heat transfer reduction can be determined reproducibly over time. In a further part, various types of the inflow are carried out on the heat exchanger and a reduction of the biofilm is thereby achieved. Values or the heat transfer resistance of fouling are measured for heat transfer types of

copper, stainless steel and PTFE. Furthermore, the reduction of the fouling is quantified by potential purification measures.

The three materials copper, stainless steel and PTFE were used. The tests were carried out with pre-clarified and unexplained municipal wastewater. In the case of the stainless steel heat exchanger, the measured heat transfer resistance was between 0.00083 (m²K)/W and 0.00112 (m²K)/W depending on the volumetric flow rate. With pre-clarified waste water, this was between 0.00075 and 0.001 (m²K)/W. In the case of the copper heat exchanger, the heat transfer resistance with untreated wastewater was between 0.00048 (m²K)/W and 0.00081 (m²K)/W at the end of the test series. With pre-clarified waste water, this was between 0.00049 and 0.00075 (m²K)/W. In the case of the PTFE heat exchanger, the value for untreated wastewater was 0.0006 (m²K)/W and for previously clarified waste water were 0.00103 (m²K)/W.

It is thus shown that the fouling growth on the copper heat exchanger is significantly slower than on the comparative heat exchangers. However, there is a clear attack on the material of the copper heat exchanger.

In order to reduce these heat transfer resistances or completely remove the fouling, different cleaning methods were investigated. An on-stream purification by increasing the flow rate was found to be effective for all heat exchangers.

By means of off-stream cleaning procedures, a nearly complete recovery of the original condition for the materials stainless steel and PTFE was achieved and no influence on the material could be determined. The surface of the transfer material copper was attacked by the wastewater within the test series and had an increased roughness after completion of the cleaning.

It has been shown that regular cleaning of the heat exchanger does not lead to optimal results from an economic point of view. Fouling should be counteracted on the basis of the heat transfer resistors published here by means of a corresponding dimensioning of the heat exchanger. A corresponding dimensioning aid was shown.

Fazit

Beschreibung der geplanten Ziele und der erreichten Ergebnisse
max. 700 Zeichen (mit Leerzeichen)

By means of the experimental design, reliable heat transfer resistances for biofilms on wastewater heat exchangers could be determined over time.

It could be shown that a cleaning of the fouling is possible by various cleaning methods. From an economic point of view, a corresponding dimensioning of the heat exchanger can be more sensible. A corresponding dimensioning aid was created for this purpose.

In principle, heat pump systems are complex individual systems. In this case, no final recommendation for a corresponding cleaning procedure or a dimensioning can be carried out.

Eckdaten

Kurztitel: AWT

Forscher / Projektleitung:

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Univ.-Prof. Dr.-Ing. Marten Brunk (im Ruhestand; ehemalige Projektleitung)

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BILDER/ ABBILDUNGEN:

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