

STUDI PERUNUTAN AIR (*WATER TRACING*) PADA BEBERAPA ALIRAN SUNGAI BAWAH TANAH DI KAWASAN KARST KARANGBOLONG BAGIAN BARAT, KABUPATEN KEBUMEN, JAWA TENGAH

INTISARI

Kawasan Karst Karangbolong bagian barat memiliki beberapa sistem aliran bawah tanah dan gua yang mempunyai nilai penting bagi masyarakat sekitar. Karakteristik sungai bawah tanah di kawasan ini perlu dikaji lebih lanjut supaya manajemen lingkungan yang tepat dapat diterapkan, sehingga sumberdaya airnya dapat terjaga secara berkelanjutan. Penelitian ini dilakukan di daerah tangkapan air Gua Barat dan Mataair Seliling yang terletak di Kawasan Karst Karangbolong bagian barat. Tujuan dari penelitian ini adalah: (1) Mengetahui sistem aliran sungai bawah tanah karst di Kawasan Karangbolong bagian barat serta menganalisis transport parameternya; (2) Mengetahui batas daerah tangkapan air sistem sungai bawah tanah di Kawasan Karangbolong bagian barat. Penelitian ini terbagi menjadi tahap pra-lapangan, tahap lapangan, dan tahap pasca-lapangan. Tahap pra lapangan meliputi studi literatur, penentuan lokasi, serta pengumpulan data sekunder. Tahap lapangan meliputi survei lapangan, pengukuran debit, serta uji perunutan pada aliran sungai bawah tanah. Sementara itu, tahap pasca-lapangan meliputi pengolahan dan analisis data. Hasil uji perunutan mampu memberikan informasi mengenai sistem sungai bawah tanah dan transport parameter aliran yang diolah dengan *Advection-Dispersion Model* menggunakan *software* Qtracer2, sedangkan daerah tangkapan air diketahui dengan menggunakan metode topografi lalu divalidasi menggunakan metode Nomogram Todd dan neraca air. Hasil penelitian menunjukkan bahwa sistem sungai bawah tanah di kedua lokasi memiliki pola lorong *curvilinear*. Sistem sungai bawah tanah Gua Barat terdiri dari Gua Mblabak, *Sinking Stream* Pagilangan, *Sinking Stream* Kalimas, Gua Pendok, Gua Barat, Gua Pengantin, dan Mataair Kalikarak, sedangkan sistem sungai bawah tanah Mataair Seliling terdiri dari Gua Nglumpit, Gua Jeruk, dan Mataair Seliling. Pengolahan *Advection-Dispersion Model* menghasilkan nilai transport parameter yang dipengaruhi oleh geometri lorong *conduit* dan kondisi aliran. Transport parameter uji perunutan Gua Barat dengan titik injeksi di *Sinking Stream* Pagilangan memiliki nilai *advection* sebesar 86,528 meter/jam, *dispersion* sebesar 0,092 m²/detik, *dispersivity* sebesar 3,38 meter, dan *recovery* sebesar 94,27%, dan *Sinking Stream* Kalimas memiliki nilai *advection* sebesar 122,85 meter/jam, *dispersion* sebesar 1,3937 m²/detik, *dispersivity* sebesar 40,84 meter, dan *recovery* sebesar 9,74%, sedangkan transport parameter Mataair Seliling memiliki nilai *advection* sebesar 95 meter/jam, *dispersion* sebesar 0,194 m²/detik, *dispersivity* sebesar 7,35 meter, dan *recovery* sebesar 6,8%. Penentuan batasan daerah tangkapan air menghasilkan nilai yang mendekati antara pendekatan topografi dengan Nomogram Todd dan neraca air. Hal tersebut disebabkan karena karakteristik sistem karst memungkinkan terjadinya “kebocoran” air keluar ataupun masuk ke dalam daerah tangkapan air.

Kata Kunci: uji perunutan, Karst Karangbolong, *transport parameter*, sistem sungai bawah tanah, daerah tangkapan air karst

**WATER TRACING STUDY ON SEVERAL UNDERGROUND RIVER
FLOWS IN THE WESTERN PART OF KARANGBOLONG KARST AREA,
KEBUMEN REGENCY, CENTRAL JAVA**

ABSTRACT

The western part of Karangbolong Karst Area has several underground flow systems and caves which have important values for the surrounding community. Therefore, the underground river characteristics of the western part of the Karangbolong Karst Region need to be studied further so that proper environmental management can be applied. This research was conducted in the Barat Cave and Seliling Springs, which are located in the western part of the Karangbolong Karst Area. The objectives of this study are: (1) To determine the karst underground river systems in the western part of Karangbolong area and to analyze its transport parameters; (2) Knowing the catchment area of the underground river system in the western part of Karangbolong area. This research is divided into three stages, namely the pre-field stage, the field stage and the post-field stage. The pre-field stage includes literature study, location determination, and secondary data collection. The field stage includes field surveys, discharge measurements, and tracing tests on underground river. Then, the post-field stage includes data processing and analysis. Tracing test results can provide information about the underground river system and transport parameters that are processed by the Advection-Dispersion Model using Qtracer2 software, while the catchment area is known using the topographic method and then validated using the Todd Nomogram and water balance method. The results showed that the underground river system in both locations had a curvilinear branchwork pattern. The Barat Cave underground river system consists of Mblabak Cave, Pagilangan Sinking Stream, Kalimas Sinking Stream, Pendok Cave, Barat Cave, Pengantin Cave, and Kalikarak Springs, while Mataair Seliling underground river system consists of Nglumprit Cave, Jeruk Cave, and Seliling Springs. Advection-Dispersion Model processing produces transport parameter values that are influenced by the conduit geometry and flow conditions. The transport parameters of the Barat Cave tracing test with the injection point at the Pagilangan Sinking Stream has an advection value of 86.528 meters/hour, a dispersion of 0.092 m²/second, a dispersivity of 3.38 meters, and a recovery of 94.27%, and Sinking Stream Kalimas has an advection value of 122.85 meters/hour, dispersion of 1.3937 m²/second, dispersivity of 40.84 meters, and recovery of 9.74%, while the transport parameter of Seliling Springs has an advection value of 95 meters/hour, dispersion of 0.194 m² /second, dispersivity of 7.35 meters, and recovery of 6.8%. The determination of the boundary of the catchment area results in different values between the topographic approach with the Todd Nomogram and the water balance method. This is because the characteristics of the karst system allow water to "leak" out or into the water catchment area.

Keywords: *tracer test, Karangbolong Karst Area, transport parameters, underground river system, karst catchment area*