

BAB V

KESIMPULAN DAN SARAN

5.1 Kesimpulan

Berdasarkan hasil penelitian yang telah dilakukan, didapatkan beberapa kesimpulan sebagai berikut:

1. Kapasitas adsorpsi protein biji kelor pada magnetit dipengaruhi oleh pH, mencapai kondisi terbaik pada pH 10,5 di mana gaya tolak menolak antar muatan protein biji kelor mencapai titik terendahnya sehingga mempermudah protein biji kelor terikat di permukaan magnetit. Sementara itu pada rentang pH 9–10 dan 11–12, terjadi gaya tolak menolak antar muatan protein biji kelor yang mengakibatkan kapasitas adsorpsi protein lebih rendah.
2. Kapasitas adsorpsi pada magnetit dengan modifikasi asam humat lebih tinggi dibandingkan dengan asam galat. Gugus hidroksil yang lebih banyak pada asam humat meningkatkan pembentukan ikatan hidrogen dengan protein sehingga kapasitas adsorpsi meningkat. Kapasitas tertinggi dengan modifikasi asam humat sebesar 34,274 $\mu\text{g eq BSA/mg}$ dan 30,957 $\mu\text{g eq BSA/mg}$ untuk modifikasi asam galat dengan pH 10,5.
3. Koagulasi zat warna kongo merah oleh protein biji kelor dengan pendekatan adsorpsi tidak berhasil akibat ikatan hidrogen antara gugus hidroksil pada asam karboksilat dengan amina pada protein lebih kuat sehingga tidak tersedia pusat aktif yang mampu menetralkan muatan negatif kongo merah.
4. Pengaruh dosis ekstrak protein, magnetit, dan konsentrasi awal zat warna pada koagulasi zat warna kongo merah oleh protein biji kelor dengan pendekatan dispersi memberikan hasil sebagai berikut:
 - a. Koagulasi zat warna kongo merah oleh protein biji kelor dengan pendekatan dispersi dipengaruhi oleh pH, mencapai *%removal* tertinggi sebesar 97,62% pada pH 3 dengan volume *sludge* sebesar 2 mL/L limbah. Sebaliknya, pada pH 3 – 10 mengalami penurunan jumlah muatan positif pada koagulan magnetik untuk mendestabilisasi koloid zat warna kongo merah, yang mengakibatkan *%removal* dan volume *sludge* semakin menurun.
 - b. Dosis ekstrak terbaik sebesar 100 mg eq BSA/L; dosis ekstrak yang terlalu rendah tidak cukup untuk mendestabilisasi koloid, peningkatan dosis ekstrak lebih lanjut

meningkatkan volume *sludge* tetapi tidak berpengaruh signifikan terhadap %*removal* zat warna.

- c. Dosis magnetit terbaik sebesar 2,5 mg/L dengan %*removal* sebesar 97,3%; keberadaan magnetit serta penambahan dosisnya mempercepat waktu sedimentasi karena adanya gaya magnet yang dibantu oleh magnet eksternal.
 - d. Konsentrasi awal kongo merah terbaik yaitu 10 ppm dengan %*removal* mencapai 95,56% dengan volume *sludge* 3,2 mL/L limbah; peningkatan lebih lanjut menyebabkan sisi aktif protein tidak lagi mampu untuk mendestabilisasi koloid zat warna kongo merah sehingga menurunkan %*removal* dan volume *sludge*.
5. Kinetika pada koagulasi dengan pendekatan dispersi menggunakan magnetit lebih cepat dibandingkan dengan ekstrak protein tanpa menggunakan magnetit. Keberadaan magnetit menyebabkan flok yang terbentuk akan bersedimentasi lebih cepat karena bantuan magnet eksternal meningkatkan gaya magnet pada magnetit. Model kinetika yang sesuai yaitu pseudo orde 2 dengan proses *chemisorption*.

5.2 Saran

Berdasarkan hasil penelitian yang telah dilakukan, beberapa saran yang dapat diberikan untuk penelitian lebih lanjut adalah:

1. Perlu dilakukan penelitian terkait adsorpsi koagulan magnetik dengan modifikasi permukaan menggunakan asam karboksilat lainnya yang dapat meningkatkan kinerja koagulasi.
2. Perlu dilakukan optimasi dosis ekstrak protein dan magnetit terhadap penambahan konsentrasi awal kongo merah sehingga didapatkan dosis yang tepat untuk setiap konsentrasi awal.

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