an intermolecular interaction between the drug and the polymer network. The hydrogel in vitro growth inhibition effect on *S. aureus* and methicillin-resistant *S. aureus* in the presence of these hydrogels confirmed that vancomycin antibacterial activity was preserved. In vitro viability of fibroblasts and mesenchymal stem cells, common wound-healing cells for 1 and 9 days revealed the viability of the cell indicating the nontoxic nature of the hydrogels [39].

Singh and Dhiman prepared hydrogels with wound fluid absorption capacity of 11.37 g/g. The hydrogel was prepared using poly-1-vinyl-2-pyrollidone and carbopol. It was loaded with moxifloxacin. The drug release profile of drug-loaded hydrogel was slow and sustained which was influenced by the high surface area and porous structure of the hydrogel. The hydrogel exhibited a high absorption of the simulated wound fluid and the hydrogel was nonhemolytic, nonthrombogenic, with good oxygen and water vapor permeability. The swelling capability of the hydrogel in simulated wound fluid was 1137.35% when compared with the swelling in pH 2.2 buffer which was 287.49% and 1100.04% in phosphate buffered solution. The presence of ciprofloxacin in the hydrogel also contributed to the pH sensitivity of the hydrogels [40]. Shi et al. prepared crosslinked hydrogel which was incorporated with ciprofloxacin by a linker cleavable by light. Irradiation of the hydrogel with a UV light of 365 nm triggered a drug release. The antimicrobial activity of the drug-loaded hydrogel was significant on *S. aureus* [41]. Singh et al. prepared sterculia crosslinked poly(vinyl alcohol) and poly(vinyl alcohol-acrylamide) hydrogel wound dressings loaded with gentamicin. The hydrogels absorbed 4.80 and 6.32 g/g simulated wound fluid and the release of antibiotic drugs was by non-Fickian and Case II diffusion mechanisms, respectively. The hydrogels were permeable to oxygen and water vapor but inhibited bacterial growth. The release of antibiotic from the hydrogel was slow [42]. Li et al. prepared pullulan-based hydrogels by chemical cross-linking followed by the loading of gentamycin sulfate. The tensile strength of the hydrogels was in the range of 0.663–1.097 MPa which was dependent on the degree of cross-linking. The water uptake of the hydrogels was high (4000%) with a high hemostatic capability. The water vapor transmission rate was in the range of 2213–3498 g/m^2/day. The water retention ability of the hydrogel was in the range of 34.74%–45.81% over a period of 6 days suggesting that the hydrogels can provide a moist environment over the wound surface thereby preventing the dehydration of the wound surface and scab formation. The hydrogels were biocompatible, cytotoxic, and significantly inhibited bacterial proliferation. The drug release was fast in the first 2 h followed by a gradual drug release from the hydrogel over a period of 40 h [43].

Roy et al. loaded ciprofloxacin, an antibiotic into keratin-based hydrogels. In vivo studies were performed on 10-mm full-thickness wounds inoculated with 10^6 colony-forming units of *Pseudomonas aeruginosa*. The hydrogels reduced the amount of the bacteria in the wound bed by over 99.9% when compared with the untreated wounds at days 3, 7, and 11. The hydrogels also promoted a reduced wound contraction and re-epithelialization at day 7. At day 11, the wounds treated with the hydrogels displayed myofibroblasts and collagen-rich granulation tissue. Between day 7–11, an increase in macrophages in the wound bed was visible. Loading ciprofloxacin into the hydrogels prevented wound infection and did not interfere with the healing process. The rate of drug release from the hydrogels was in the range of 50%–63% in 5 days and it was not dependent on the initial concentration of ciprofloxacin [44]. Namazi et al. reported nanocomposite hydrogel prepared from mesoporous silica MCM-41 as a nanodrug carrier into carboxymethylcellulose hydrogel. The hydrogel was loaded with tetracycline and methylene blue. The nanocomposite hydrogel-swelling capacity was significant with antibacterial activity on *S. aureus* [45]. Choi et al. prepared hydrogels loaded with neomycin. They were prepared from varied amount of poly(vinyl alcohol), sodium alginate, and poly(vinyl pyrrolidone) by freeze thawing method. The hydrogel composed of poly(vinyl alcohol), sodium alginate, poly(vinyl pyrrolidone), and neomycin in the ratio 10/0.8/0.8/1 released 85% of the loaded drug within 2 h. The wound curing effect of the hydrogel was attributed to its capability to provide a moist environment with a good swelling capacity which is useful for the migration of cell growth factors. However, the loaded drug did not have any significant influence on the wound curing ability of the hydrogels [47].

3.2. Hydrocolloids

Hydrocolloid dressings are composed of materials such as pectin, carboxylmethylcellulose, gelatin, and cellulose incorporated in an adhesive film or foam (Fig. 5). They are characterized by an interaction between the materials and the wound exudates resulting in their swelling. However, they are not permeable to gas, vapor, water, and bacteria [47–49] . Their transparent appearance makes it possible to easily monitor the wound healing and wound exudate. They leave residue in the wound bed and are not suitable for high exuding wounds, bleeding wounds, and infected wounds [47].