Abstract

Solanum alkaloids were isolated from plants of the family *Solanaceae* (*Solanum*). These are steroidal alkaloids whose structure is based on the C27 cholestan skeleton. The main representatives of this class of compounds are solasodine, tomatidine and solanidine. Steroidal alkaloids are known to possess a variety of biological properties such as: antiproliferative, neurogenic, anticonvulsant and antiinflammatory. The wide range of biochemical activity and the low concentration of these compounds in plant material inspired chemists to design their synthetic analogues. The most famous representative of this group of compounds is solasodine – a nitrogen analog of diosgenin. Thus it seems to be the first-choice starting material for the synthesis of solasodine derivatives. The solasodine syntheses from diosgenin proposed so far are based on three-stage strategy: F-ring opening (stage I), nitrogen nucleophile substitution of the side chain leaving group (stage II) and F-ring closure (stage III). My research was focused on designing, synthesis and evaluation of biological activity of solasodine and analogues. The main purpose of this dissertation was to develop a convenient strategy for the simultaneous opening of the F ring and the nitrogen atom introduction in the C26 position (with the use of eg. azides, carbamates) which may constitute promising method for obtaining the solasodine and its derivatives. The research carried out in this strategy allowed for the development of a two-step synthesis of solasodine pivalate.

I also studied an attempt of a direct transformation of spirostanes (diosgenin) into spirosolanes (solasodine) by a new reagent – diisobutylaluminum amide, readily available from diisobutylaluminum hydride (DIBAL) and ammonium chloride. I was looking for the paths of the syntheses of 26a-homo-, and 22a(*N*)-homo analogues of solasodine and their *N*-acyl derivatives. I assumed that the derivatives with 7-membered F ring might exhibit similar biological properties to their parent compounds. The synthesized derivatives were tested for their antiproliferative and antineurodegenerative properties. In my research, I was looking for methods of synthesis other aza-steroids, including pyrimidobenzimidazole derivatives which were obtained by condensation of 16-dehydropregnenolone acetate with 2-aminobenzimidazole. The optimized reaction conditions (influence of the catalyst, reaction time, type of solvent, concentration of individual reactants) allowed to obtain a total of 6 new analogues. The obtained derivatives showed very good antitumor activity against prostate cancer cell lines. All obtained results of my presented in this dissertation have been described in 5 international publications and have been presented at numerous foreign and national conferences.

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